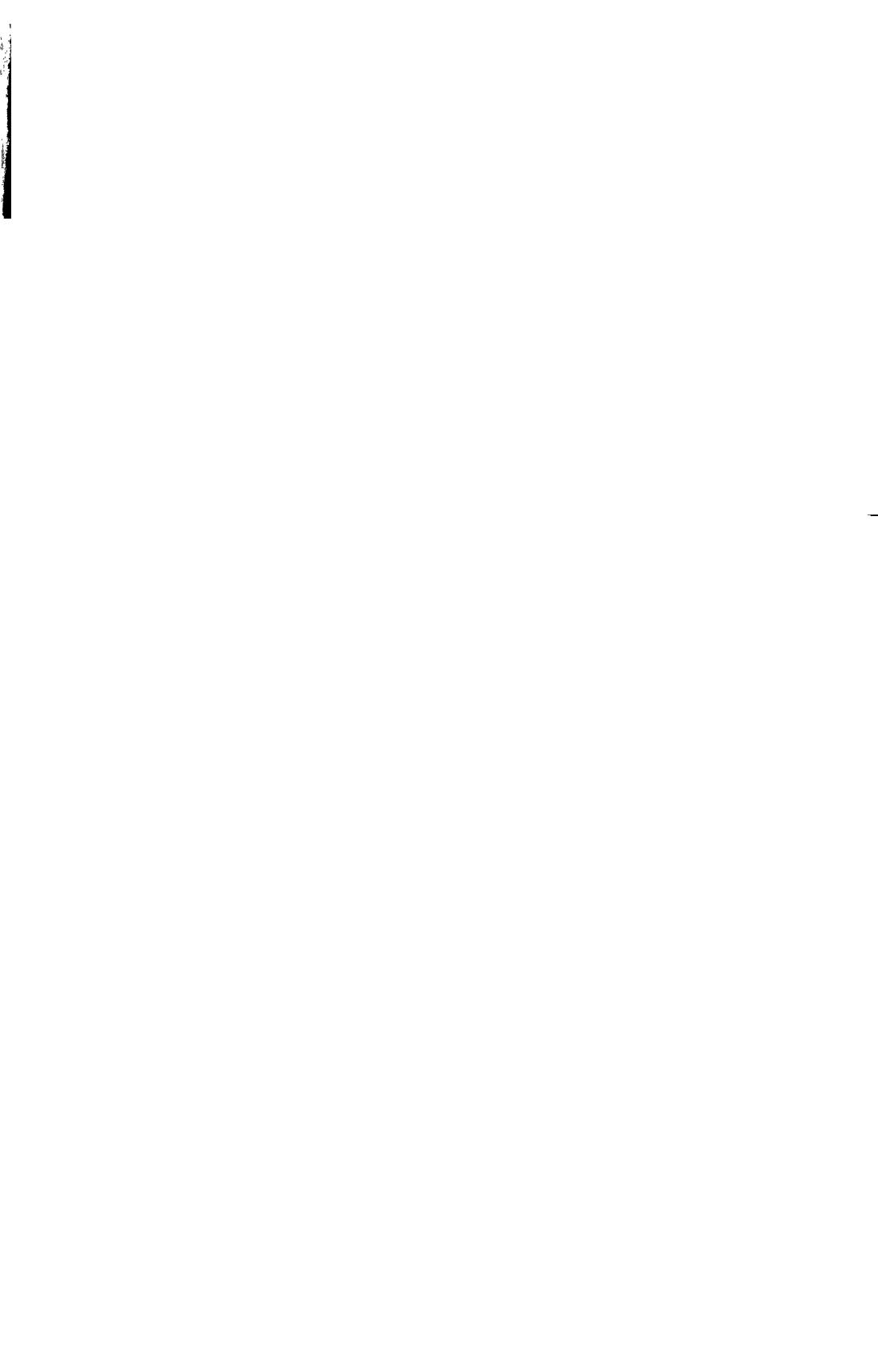


GOVERNMENT OF INDIA
DEPARTMENT OF ARCHAEOLOGY
CENTRAL ARCHAEOLOGICAL
LIBRARY

CLASS _____

CALL NO. B358 _____

D.G.A. 79.

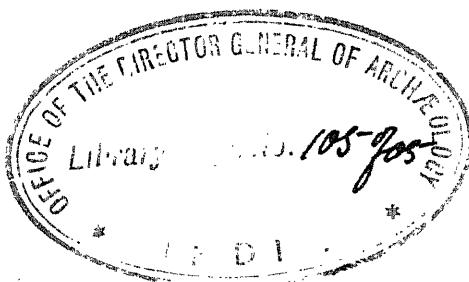


GOVERNMENT OF INDIA
DEPARTMENT OF ARCHAEOLOGY
CENTRAL ARCHAEOLOGICAL
LIBRARY

Acc. No.
CLASS 20301

CALL No. 693.02 / Pur.

D.G.A. 79.



GLOSSARY OF TERMS

USED IN

MASONRY AND STONE CUTTING.

PRACTICAL MASONRY

A GUIDE TO THE ART OF STONE CUTTING

COMPRISING

THE CONSTRUCTION, SETTING-OUT, AND WORKING OF STAIRS,
CIRCULAR WORK, ARCHES, NICHES, DOMES, PENDENTIVES,
VAULTS, TRACERY WINDOWS, ETC. ETC.

*FOR THE USE OF STUDENTS, MASONS, AND
OTHER WORKMEN*

BY

WILLIAM R. PURCHASE

BUILDING INSPECTOR TO THE BOROUGH OF HOVE

S. J. ORPWOOD.
Litho. by J. C. L.

With 52 Lithographic Plates, comprising over 400 Diagrams

THIRD EDITION, WITH GLOSSARY OF TERMS

693.02

Pur.



LONDON

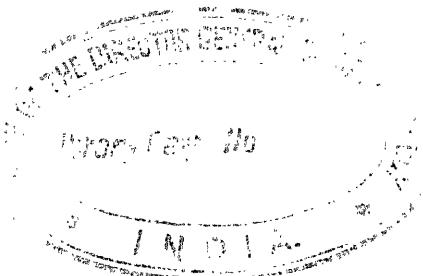
CROSBY LOCKWOOD AND SON

7, STATIONERS' HALL COURT, LUDGATE HILL

1900

Acknowled

CENTRAL ARCHAEOLOGICAL
LIBRARY, NEW DELHI.
Acc. No. 2080/...
Site. 11/... 4/... SS-
all No. 693-02/Pur.



Practical Masonry

PREFACE.

THIS work has been compiled, not with the view of superseding any of the works already published dealing with the architectural or geometrical side of the stone-cutter's art, but as a means of introducing the student of Masonry to the practical work of everyday life in the workshop and on the building. It has no pretensions to instruct skilled workmen, but is intended to initiate young beginners in the craft into the rules and principles of good masonry. It is the result of many years' attentive observation and practical experience, acquired by the Author first as an operative stone-mason, and afterwards as a foreman mason, on some of our largest public buildings.

All the cases commonly met with are worked out, and, when the general principles applying to these are understood, their extension to any unusual question which may occur should not be difficult. The student is assumed, however, to have some knowledge of geometrical drawing and projection, which indeed is indispensable. Most of the examples given are from actual work.

In further explanation of his aim in compiling the volume, the Author may be allowed to cite the subjoined extract from an address delivered a couple of years ago by Mr. J. H. Morton, F.R.I.B.A., President of the Northern Architectural Association.* Mr. Morton said that "it must be allowed that "no trade could be properly learned out of the workshop;

* Address at opening of winter session of the Association at Newcastle-on-Tyne, reported in the "Builder" of December 9, 1893.

“although the men would certainly understand better the instruction given in the workshop, if they had had the benefit of a theoretical foundation before proceeding to practice. It was useless to expect the technical school to entirely replace the apprenticeship system; but having laid the foundation before entering the workshop, the technical education of the artisan might go on contemporaneously with the workshop employment. Many workmen, of excellent practical skill, worked entirely by rule of thumb, and their efforts would assuredly prove more successful if guided by the enlightenment and precision of scientific knowledge. Thus technical education might be the means of exalting labour, and of enabling capable workmen to raise themselves to a higher standard by the acquisition of a more perfect knowledge of the art of building.”

Any suggestion with which the Author may be favoured, with a view to the improvement of the work in future editions, will be duly acknowledged, and carefully considered as opportunity occurs.

W. R. P.

Hove,
October, 1895.

NOTE TO THE SECOND EDITION.

The reception accorded to the first edition of this work has been very gratifying, no adverse criticism having as yet come to the Author's knowledge. On the contrary, he has received numerous letters conveying the assurance that the work has been found of the greatest value. It is at the request of some of his correspondents that two additional Plates, illustrative of Grecian and Roman mouldings respectively, and also a GLOSSARY OF TERMS, have been added to the present edition, and he trusts these will prove helpful additions.

W. R. P.

Hove,
July, 1898.

TABLE OF CONTENTS.

TOOLS AND APPLIANCES.—PLATES I. to III.

	PAGES
Squares—Mallet—Hammer—Chisels—Boasters—Claw-tool—Pitcher—Jumper—Drags—Dummy—Cross-cut saw—Pick—Axe—Patent axe—Spalling hammer—To frame up a saw, for hand sawing—To cope or split a block of stone or granite—Wedges—Plugs and feathers—Lewises—Dogs or Nippers—Trammel heads—Platform or drawing board—Sheet zinc	1—10

ARCHES AND JOINTS.—PLATES IV. to VIII.

Definition of arches—Segment arch, and joints—Semicircular arch and joints—Semi-oval arch and joints—Semi-elliptic arch and joints—Equilateral arch and joints—Lancet arch and joints—Drop arch and joints—Tudor arches and joints—Flat or straight arches and joints—Joggle joints, Secret arch joint—Saddle or water joint in cornice—Rebated joint in coping—Bed joints in spires—Dovetailed joints—Dowels and cramps	11—22
--	-------

MASONRY DETAILS.—PLATES IX. to XI.

To form a plane surface—To form a winding surface—To form a cylindrical surface—To work a length of cornice—Various examples of dressing stone—The entasis of a column, by two methods—To diminish or enlarge a section—To draw raking moulds—To draw a stretching mould—To set out the Grecian fret	23—32
--	-------

STAIRCASES.—PLATES XII. to XV.

Definitions of steps—Proportions of the tread and rise—To set out a spandril step—Plan of a good type of stair—Part plan of winders, and development—Bed mould, and well-hole mould—Working of	
--	--

	PAGES
the winders—A spiral stair with solid newel—A sketch of one of the winders—A spiral stair with open newel—Development of the winders—Bracketed steps—Solid steps—Treads and risers—Method of sawing spandrel steps	33—41

CIRCULAR WORK (RAMP AND TWIST).—

PLATES XVI. to XIX.

A terrace stair, circular on plan, with raking balustrade—Plan of balustrade and steps—To set out the development of outside and inside elevation, and moulds for the same—To work the plinth block—A sketch of the finished plinth—To work the length of capping—A sketch of the finished length of capping—Section of the balustrade	42—48
--	-------

ARCHES, CIRCULAR ON PLAN.—PLATES XX. to XXIII.

A semicircular arch in a cylindrical wall, the soffit line at springing converging to a centre—To set out the plan and developed elevations—The bed and face moulds—Working of the arch stones, or voussoirs—A sketch of segment of hollow cylinder—A sketch of one of the arch stones—A semi-circular arch in a cylindrical wall, the soffit line at springing being parallel to the axis of cylinder—To set out the plan and developed elevations—The bed and face moulds—Working of the arch stones—Diagrams of the developments—Working of small models	49—58
---	-------

SKEW ARCH AND NICHES.—PLATES XXIV. to XXVI.

To set out an oblique semicircular arch rib—Plan and elevation of the arch—The face and joint moulds—Working of the arch stones, or voussoirs—To set out a spherical niche, with horizontal beds—Plan and elevation of the niche—The bed and face moulds—Working of the stones—To set out a spherical niche, with joints radiating to a centre—Plan and elevation of the niche—The bed and face moulds—Working of the stones—A sketch of one of the finished stones	59—68
---	-------

CYLINDRICAL VAULTING.—PLATES XXVII. to XXIX.

	PAGES
To obtain the profiles of the rectangular and annular groins—To set out a rectangular cylindrical vault—The bed and section moulds—Working of the angular groins—Working of the key-stone—Sketches of the several stones—A sketch of the vault	69—76

DOMES & PENDENTIVES.—PLATES XXX. to XXXIII.

Definitions—A square area covered by a dome and supported by pendentives—To set out the plan and sectional elevation—The bed, face, and section moulds—Working of the stones—A sketch of one of the stones in dome—A spheroidal dome—To set out the plan and section—The bed and section moulds—Working of the voussoirs—A sketch of one of the finished voussoirs—A sketch of the dome	77—88
---	-------

GROINED VAULTING.—PLATES XXXIV. to XXXVII.

A groined vault in four compartments, square on plan, and supported by a central shaft—To set out the plan (one quarter) of the vault—The bed and section moulds of the springers—Working of the springers—The bed and section moulds of centre key—Working of the key-stone—A sketch of the rib—Working of the rib—A sketch of part of the vault—Skeleton plan of vault	89—99
--	-------

GROINED VAULTING (*continued*).—PLATES XXXVIII.
to XLI.

To set out the plan (one quarter) of the vault, and elevation of the ribs—Plan of the springer—The bed and section moulds of the bosses—Working of the boss stones—A sketch of part of the vault—Part plan of vault, Houses of Parliament	100—108
---	---------

TRACERY WINDOWS.—PLATES XLII. to XLVI.

Their infinite variety—Geometrical tracery, based on the equilateral triangle, the polygon and circle—Setting out windows generally—Constructional lines of equilateral window—Equilateral	
--	--

	PAGES
window completed—Constructional lines of circular window—Circular window completed—Constructional and completed lines of pointed windows—The face and section moulds of springer—Working of the springer—Sketches of various cusps	109—116
GOTHIC MOULDINGS.—PLATES XLVII. to L.	
Their general characteristics—Profiles of the Norman period, 1066 to 1189—Of the Early English period, 1189 to 1300—Of the Decorated period, 1300 to 1377—Of the Perpendicular period, 1377 to 1547	117—125
GRECIAN MOULDINGS.—PLATE LI.	
Their general characteristics—Types of mouldings	126, 127
ROMAN MOULDINGS.—PLATE LII.	
Their characteristics as compared with their Greek originals—Types of mouldings	128, 129
 <hr/>	
GLOSSARY OF TERMS USED IN MASONRY AND STONE CUTTING	131—142

PRACTICAL MASONRY.

PLATES I., II., III.—TOOLS AND APPLIANCES.

Fig. 1.—The square is of various sizes, and generally made of iron plate about one-eighth of an inch thick; the edges are parallel and at right angles to each other.

It is important that the square should be true, as the accuracy of the work depends entirely upon it, and for this reason it should be frequently tested for correctness.

Fig. 2.—The set square is of several sizes, and made of iron, brass, or zinc plate; it contains a right angle and two angles of forty-five degrees, and is used chiefly for mitres, and setting out on bed of work.

Fig. 3.—The bevel, or shift stock, made of iron or brass, and used for sinkings, bevels, &c.

Fig. 4.—A small tee square of unequal sides, and with right angles, used for sinkings, &c.

Fig. 5.—Mallet of beech, or other hard wood, of various sizes, for striking the cutting tools.

Fig. 6.—Hand hammer of steel, about five pounds in weight, used principally with punch for removing waste, and, in very hard grit stones, it is used also with hammer-headed chisels.

Fig. 7.—The punch: the cutting edge of this tool is about a quarter of an inch wide, and chisel-pointed. It is used with the hammer for removing all superfluous waste.

Fig. 8.—The point, with edge similar to punch, is used with mallet, generally for hard grit or lime stones, and for reducing the irregularities left from punch, leaving the stone in narrow ridges and furrows close down to face.

Fig. 9.—Chisels, of various widths, from a quarter of an inch to one and a half inch wide, used for mouldings, fillets, sinkings, &c.

Figs. 10 & 11.—Boasters, from one and a half inch to three inches wide, used for dressing stone down to smooth faces, and cleaning or finishing mouldings, &c.

Fig. 12.—Broad-tool, about four inches wide, used for tooling.

Fig. 13.—Claw-tool. These are of various sizes, the teeth being cut coarse or fine to suit the texture of the stone. For hard lime stones the teeth at point are about an eighth of an inch wide, and for softer stones from a quarter to three-eighths of an inch wide.

The claw-tool is used after the punch or point, dressing down the ridges still closer to finished face.

Figs. 14 & 15.—Small chisels, of various sizes, for carving, letter-cutting, &c.

Note.—Numbers 8 to 15 are mallet-headed tools, and must never be struck with the hammer, the heads being made to receive the blow of the mallet only.

Fig. 16.—Small chisels, called “splitters,” of various sizes ; the heads are concave, or cup-headed, as in sketch. When used with an iron hammer (Fig. 21), they cut very smooth and sweet.

They are used mostly for marble work, carving, lettering, &c.



Fig. 17.—Pitching tool : this has a bevelled instead of a cutting edge, and is used with the hammer, for pitching or knocking off the irregularities or waste lumps on stone.

Fig. 18.—Jumper, chisel-pointed and slightly round-nosed ; it is wider at cutting edge than the diameter of tool, so that it clears itself in cutting circular holes, for which it is used, chiefly in granite.

FIG. 1

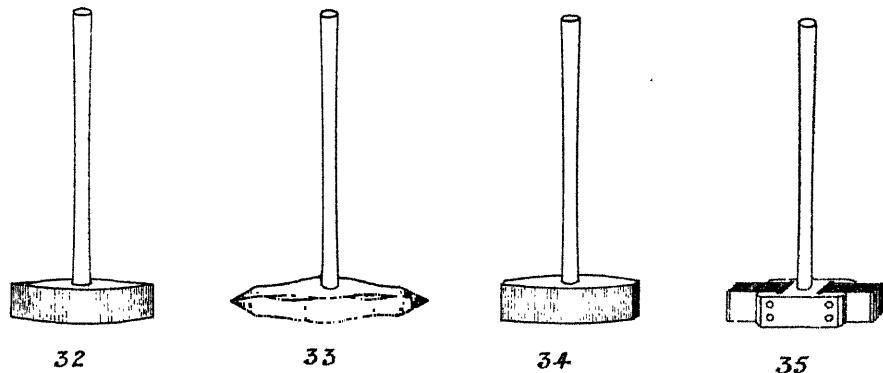
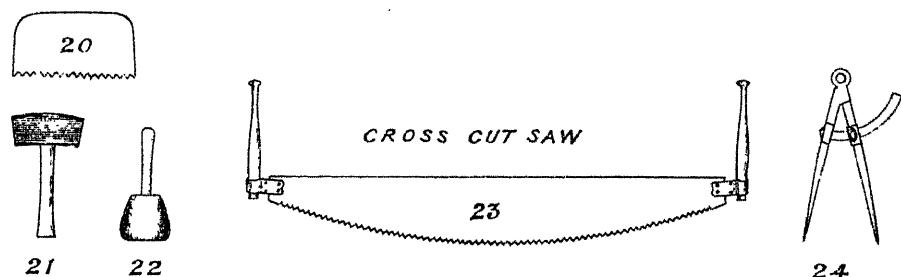
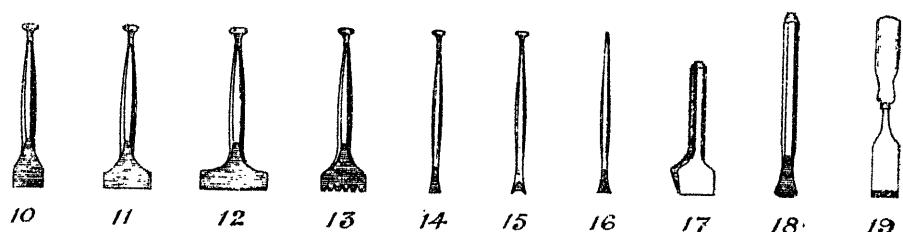
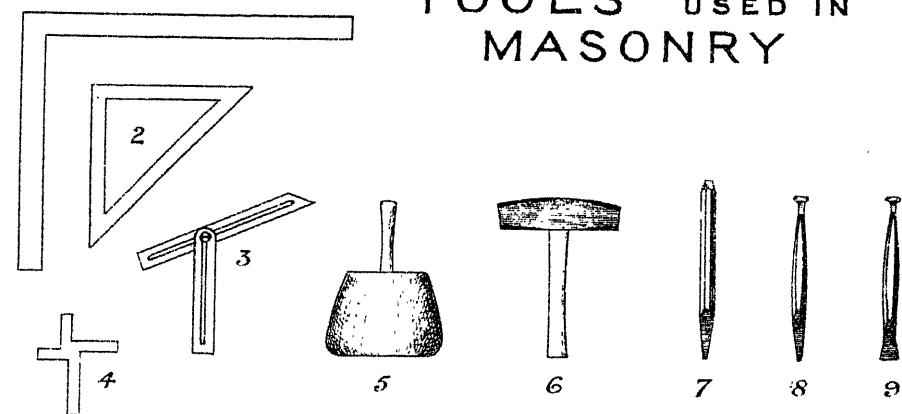
TOOLS USED IN
MASONRY

Fig. 19.—Chisel for soft stone (this is a general term, and comprises varieties like Bath, Ketton Beer, Caen stone, &c., as well as Alabaster). The chisels have wood handles, and are similar to carpenters' "firmer chisels."

Fig. 20.—Drags for soft stone, of best steel saw-plate, with coarse, middling, and fine teeth, called coarse, seconds, and fine drags. These are used by traversing the face of the stone in all directions, and removing the saw and chisel marks, and finishing to any degree of smoothness required.

Fig. 21.—Iron hammer, about three or four pounds weight, used with cup-headed tools, for carving, lettering, &c.

Fig. 22.—Dummy, of lead or zinc, about three or four pounds in weight, used for striking the soft stone tools; it is handier than the mallet, and at times more convenient to use.

Fig. 23.—Cross-cut saw, of best steel plate, and of various sizes, for cutting soft stone blocks, scantlings, &c.; the teeth are coarse, and broadly set for clearance. Two men are required in using it.

Fig. 24.—Compasses, for setting-out work, &c.

Fig. 25.—Shews sketch of a saw-frame, for hand-sawing, which in practice requires some little skill in framing up to the various sizes.

The frame generally, for good working, should be about two feet longer inside than the length of stone to be sawn, so as to allow for draft.

The heads or ends of frame are made of $4'' \times 3''$ deal, tapered from near the top to $3\frac{1}{2}'' \times 2''$ at the bottom, with a groove or slot for the saw four inches deep by half an inch wide, the angles being rounded off or smoothed to make it easy for the hands.

The stretcher is a piece of pole about three inches in diameter, with iron ferrule at each end, varying in length. Packing pieces are used against the head at each end of stretcher, as shewn.

The couplings are in wrought iron, half an inch in diameter, of various lengths and shapes, as in sketch. These are tightened up with a union screw in the centre, which keeps the saw taut, so that no difficulty is experienced in getting the saw-frame to the required length.

The saw-plate is of iron, about four inches wide by one-tenth of an

TOOLS USED IN MASONRY

FIG. 28

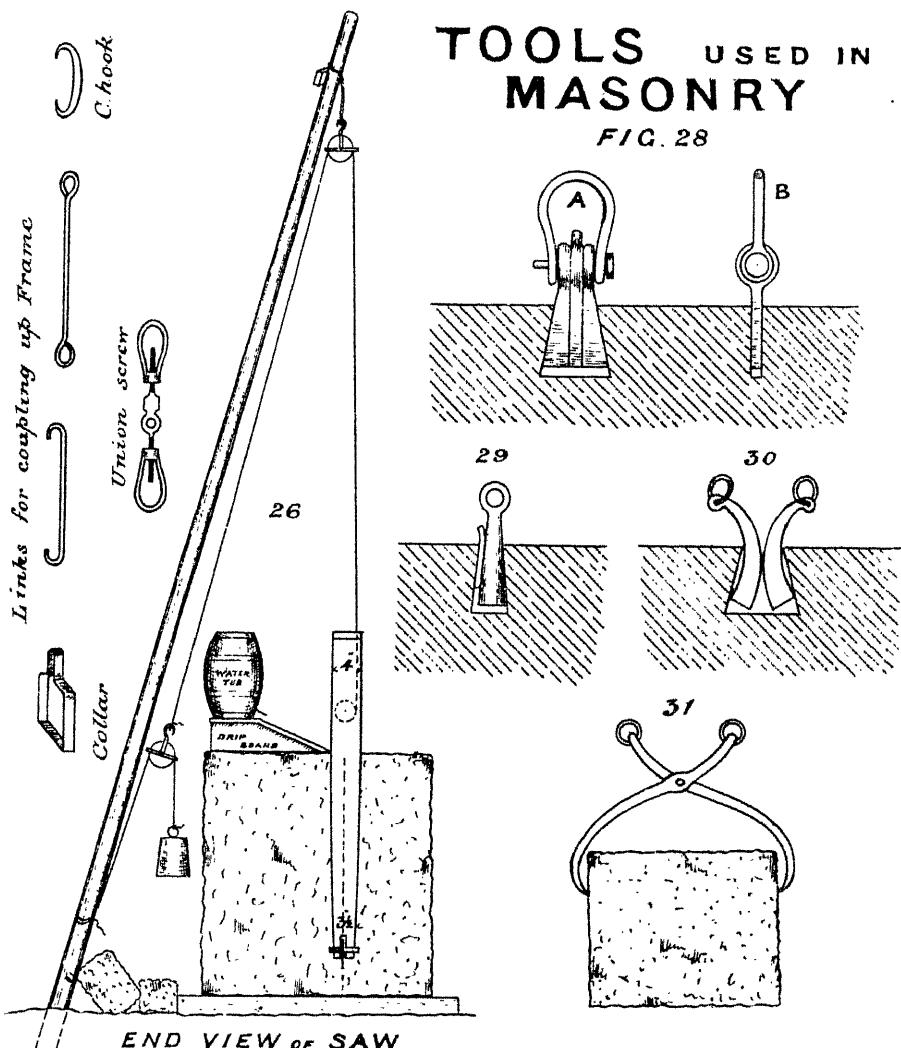
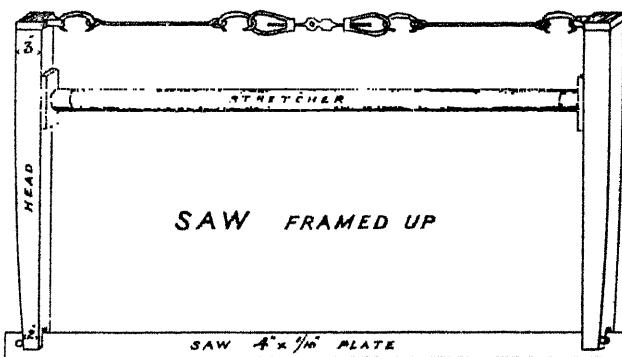


FIG. 25



inch thick, with two holes punched through it, three-quarters of an inch in diameter, at each end, for iron pins, which are inserted to keep the saw in position. The pins are four inches long, and have a small slot the thickness of the saw-plate and one-eighth of an inch deep, fixed with the groove towards the end of the saw; this enables the sawyer to keep the saw straight down the cut, by tapping either end of the pin, should the saw deviate from the vertical line. This slot in the pins is important, as the saw cannot be kept true without this arrangement. The pole, for carrying the saw-frame, is from sixteen to twenty feet long and three or four inches diameter at bottom, and tapering towards the top; a cross-piece and chain is secured nearly at the top of pole to carry the pulley. The pole is kept in position by planting it in the ground, and a rough piece or two of stone is laid against it. The cords for carrying the saw-frame are about half an inch in diameter; small chains are sometimes used, but cords work more easily.

The cord is fastened round the stretcher and over the pulley on top of the pole (which must be vertical to the cut), and then round hook of bottom pulley. The weight must be so adjusted as to allow the saw-frame to be the heavier by about eight or ten pounds; this, however, will depend greatly on the nature of the stone. The position of weight can be raised or lowered to suit the cut by shifting the cord at the bottom of the pole.

The drip-board is of deal, as in sketch, and about two feet long, with sloping side against the cut, and on this is placed the water tub; a small spigot is inserted in the bottom of the tub, and is adjusted to allow the water to trickle down the board, carrying with it the sand, which is also on the board, into the cut. To regulate the supply of water and sand, the sawyer uses a small rake with long handle.

The line of cut for saw should be set out with a plumb rule or bob at each end of the block, and a V shape chase cut in to guide the sawyer in keeping to a true line.

The best sand for cutting is flint road grit, washed through several sieves, all the coarse and fine being rejected, and the medium size only used. A bushel of this sand will cut about twelve feet super of Portland stone.

The saw is drawn backwards and forwards, and the stone cut by the attrition of the saw-plate with the sand and water.

A good sawyer can cut by hand from fifteen to twenty feet super of Portland stone in one day of ten hours.

On large jobs steam stone saw-frames are used, in which, if necessary, from one to twenty cuts may be put in one block at the same time.

Fig. 27.—Shews a method of coping or splitting a block of stone to a required size.

Begin by cutting a V chase on top and two sides of the block, as at *g f e*; directly under this place a wood skid, and on the top of the skid a long iron bar, which should bone with the line *gf*, or a punch driven in on each side, as at *e*, will do nearly as well. At extreme end place a short skid, as at *h*, and packed up to within an inch of the underside of the block. This is done to prevent the coped piece from breaking under by its own weight, as the fracture would not take the line of direction proposed, but would probably break away from *j* to *k*, and spoil the block.

Sink wedge holes with the punch (at distances apart varying with the nature of the stone) to as fine a point as possible at the bottom of the hole, as in sketch at *b*, so that the wedge will bite or hold when struck with the hammer. The apex of the wedge, which is of iron, is blunt-pointed and about a quarter of an inch wide, so that it does not touch the bottom of the hole, or when struck it would jump out. The holes being cut, the wedges are inserted in each one: care must, however, be taken to keep them upright, so that the cleavage takes the line of direction required. The wedges are now gently tapped with a heavy hammer, till all have got a hold; then harder blows are given in quick succession, and the fracture takes place.

a shews sketch of wedge, made of iron, and from four to five inches long and one and a half inch wide.

In coping or splitting granite, wedge holes are not cut as in stone, but circular holes are "jumped," one inch or one and a quarter inch in diameter and about five inches deep, at distances apart varying with the obstinacy of the material, and plugs and feathers are inserted and driven in as for stone. The plug is of soft steel, and made tapering as at *c*.

The feathers are thin pieces of iron, concave in section, as shewn at *c 1*. These are first put in the holes, the plugs are then driven in until they become tight, and a few sharp hard blows are all that is necessary to complete the process of splitting. *c 1* is a plan of *c* to a larger size.

Fig. 28.—Shews a pair of iron lewises used in lifting worked stone for fixing. The lewis consists of a dovetail of three pieces, the two outer pieces being first inserted in the hole, and then the centre piece, which acts as a key, and tightens up the dovetail; the shackle is next put on, and the bolt is passed through the whole.

Care must be taken to cut the hole to a dovetailed shape, and of the size of the lewis.

A is the front view, and *B* the side view, of the lewises.

Fig. 29.—Shews an iron conical-shaped lewis plug, which is placed in a slightly larger dovetailed hole, a small curved iron plug being inserted by its side, which keys it up. This is used chiefly for worked granite.

Fig. 30.—A pair of chain lewises, consisting of two curved iron plugs with rings for chain; these are inserted in a dovetailed hole, and when tightened up act similarly to the ordinary lewises.

Fig. 31.—A pair of iron dogs, or nippers, with steel-pointed claws, used for lifting rough blocks, and also for fixing.

Fig. 32.—Axe, about twelve or fourteen pounds in weight, chisel-pointed, used on granite for removing the inequalities left by the pick and dressing it similarly to tooled work in stone, shewing the marks or indents in parallel lines.

Fig. 33.—Pick, about sixteen pounds weight, used chiefly on granite, for dressing the inequalities of the rough or rock face down to within half an inch of the finished face; and also used for scabbling blocks of stone roughly to the required shape.

Fig. 34.—Spalling hammer, about twelve to fourteen pounds weight. This has a square edge of about an inch and a quarter, and is a very effectual tool for knocking off rough lumps.

. **Fig. 35.**—Patent axe. The body of this is of iron, with a slot at each end, into which a number of parallel thin plates of steel, chisel-sharpened and of equal length, are inserted and tightly bolted together. This is used for granite, and produces the finest description of face, next to polishing.

Fig. 36.—A pair of trammel heads, or beam compasses, used chiefly for setting out arcs of circles full size; those made of gun-metal, with steel points, are the best, and a set should be large enough to take a rod thirty feet long.

Fig. 37.—A spirit level for fixing.

The following appliances are also required for setting out work :—

A large platform or drawing-board, about ten or twelve feet square; or

TOOLS USED IN MASONRY

Trammel heads & Rod

36

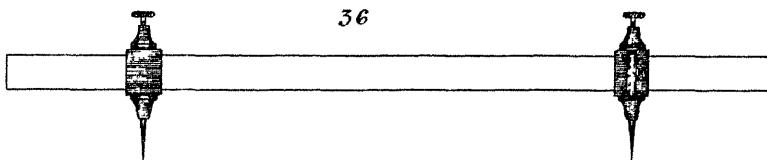


FIG. 37



LEVEL

C 1

— Plug
— feather



a

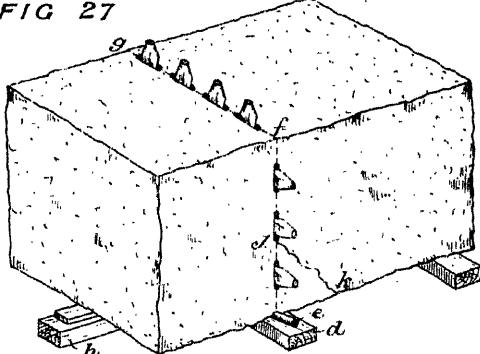


b



c

FIG. 27



COPING OR SPLITTING BLOCK
BY WEDGES

if larger than this, the better. It may be fixed either vertically or horizontally.

A standard five-foot rod.

Two or three straight-edges of various lengths.

Deal rods for storey rods, and for setting out lengths of cornices, modillions, dentils, &c.

Pipe-clay and stiff brush, for cleaning off board, rods, &c.

Sheet zinc for moulds, usually No. 9 gauge, this being a good workable thickness. The lines for face, bed, and section moulds have to be carefully transferred to the sheet zinc, and cut to their proper contour or shapes with shears and files.

The foregoing lists do not comprise all the tools and appliances required for every branch of masonry, but only those which are in common use.

All cutting tools are made of the best cast steel, except the pick, axe, and spalling hammer, which are sometimes of iron, steel pointed and faced.

PLATES IV., V., VI., VII., VIII.—ARCHES AND JOINTS.

THE terms used in connection with the arches here shown may be thus defined:—

The face of the arch is the *front*, or that portion shown in elevation.

The *under-surface* or *soffit* is called the *intrados*, and the outer surface the *extrados*.

The *voussoirs* are the separate arch blocks composing the arch, the central one being the *keystone*.

The *springers* are the first or bottom stones in the arch on either side, and commence with the curve of the arch.

The *skewbacks* generally apply to segmental arches, and are the stones from which an arch springs, and upon which the first arch stones are laid.

The *span* of the arch is the extreme width between the piers or opening; and the *springing line* is that which connects the two points where the intrados meets the imposts on either side.

The *radius* is the distance between the centre and the curve of the arch.

The highest point in the intrados is called the *crown*, and the height of this point above the springing is termed the *rise* of the arch.

The *centre* is a point or points from which the arch is struck; and lines drawn from this centre or centres to the arch are radiating joints, and are also called *normals*.

All joints in arches should be radii of the circle, circles, or ellipses forming the curve of the arch, and will therefore converge to the centre or centres from which these are struck.

Fig. 1.—Shews a segmental arch, in which the above-mentioned terms are illustrated.

Fig. 2.—Is a semi-circular arch, *A B* being the span and *C D* the rise; the left-hand half has the ordinary joints radiating from the centre

C, and the right-hand half, with rebated or step joints, also radiating from the centre *C*. This last is a sound and effective joint where great strength is required, and there is also no tendency to sliding of the voussoirs.

Fig. 3.—Shews a semi-oval arch, approaching in form that of the ellipse, and struck with three centres. This form of arch has a somewhat crippled appearance at the junction of the small and large curves, and is on that account not pleasing to the eye.

It may be here observed that the true ellipse is obtained from an oblique section of the cone, and no portion of its curve is any part of a circle, and cannot, therefore, be drawn by the compasses or from centres.

The method of setting out and drawing the joints requires but little explanation, *A B* being the span, *C E* the rise, and *D D* and *F* the centres, from which the curve is struck, the joints converging to their respective centres.

The left-hand half is shown with square bonding on face, and the right-hand half shows line of extrados.

Fig. 4.—Is a semi-elliptic arch.

On comparing this with the arch shewn in Fig. 3, which is of the same span and rise, the gracefulness of the elliptic arch will be apparent.

To draw the arch joints:—

Divide the soffit into any convenient number of parts, and find the foci by taking *C* as centre and *A E* equal to half the major axis as radius, and describe an arc cutting line *A B*, giving the foci *F* and *F'*. From *F* and *F'* draw lines to *H* (one of the divisions for the arch joints) and bisect the angle *F H F'*; the bisecting line *H O* produced will be perpendicular to the tangent of the curve, and will give a true radiating joint.

The other joints are found in the same manner.

Fig. 5.—Shews an equilateral arch, described about an equilateral triangle *A B C*, the centres *A* and *B* being at the extremities of the span.

The joints are drawn to the radii or centres *A* and *B*.

Fig. 6.—Is the lancet-shaped arch, described about an acute-angled triangle *A B C*, the radius *D E* being longer than the span of the arch.

The joints are drawn from the centres *D* and *D'*.

ARCHES AND JOINTS

FIG. 1

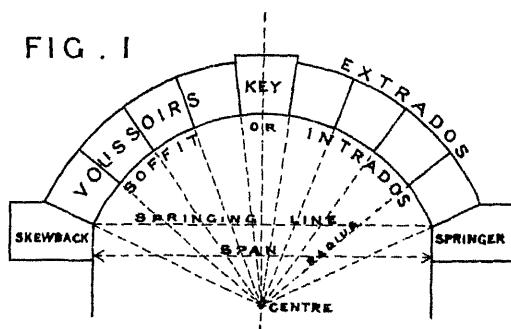


FIG. 2

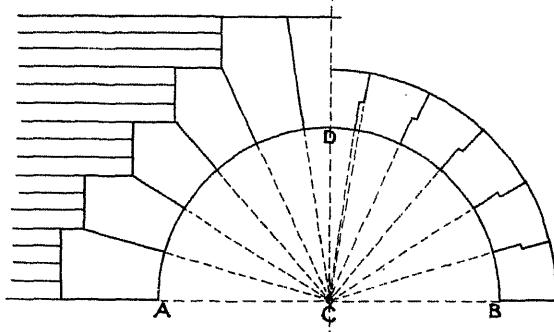
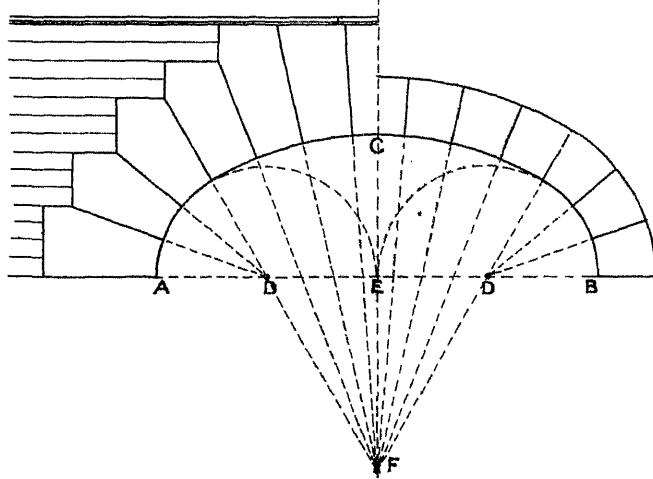


FIG. 3



ARCHES AND JOINTS

FIG. 4

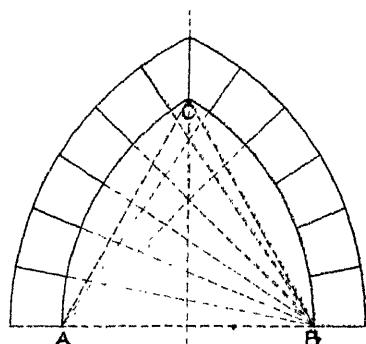
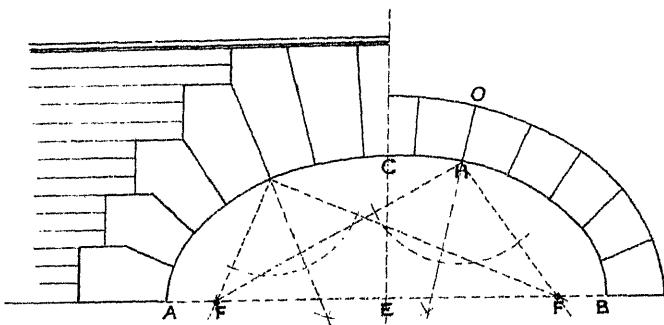


FIG. 5

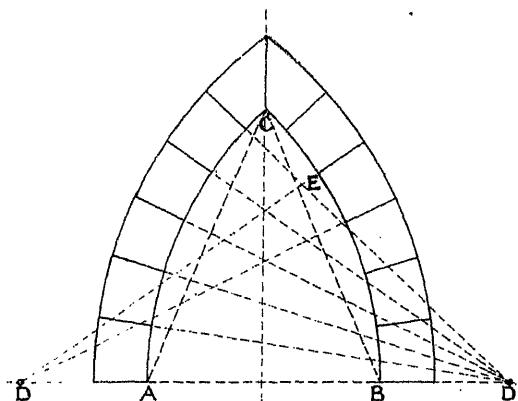


FIG. 6

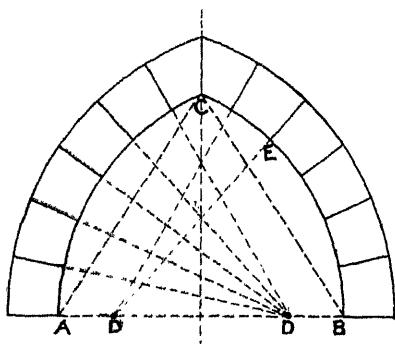


FIG. 7

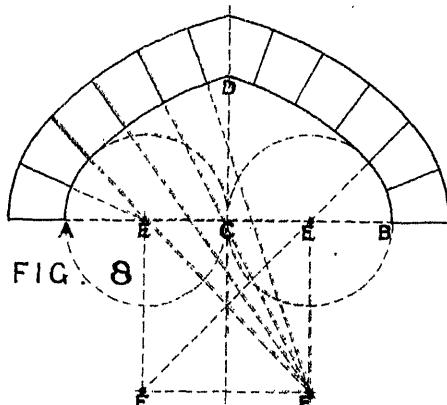


FIG. 8

Fig. 7.—Is the drop arch, described about an obtuse-angled triangle $A B C$, the radius $D E$ being shorter than the span of the arch.

The joints are drawn from the centres D and D .

Fig. 8.—Shews the four-centred or Tudor arch, $A B$ being the span and $C D$ the rise; two of its centres, $E E$, are on the springing line, and the two others, $F F$, below it.

The joints are drawn from the centres $E E$ and $F F$ as shewn, and require no further description.

Fig. 9.—Is a Tudor arch, based on the curve of the hyperbola.

Let $A B$ be the span and $C D$ the rise of arch: erect perpendicular at A , and make it equal in height to two-fifths of the rise as at $A C$, and draw the line $C D$. Now divide the lines $A C$ and $C D$ each into six equal parts, and draw lines from 1 to 1, 2 to 2, 3 to 3, &c., and the line drawn through the intersection of these points gives the curve of one side of the arch. The other side is obtained similarly.

A thin flexible lath is generally used for guidance in drawing an easy curve through the points of intersection.

To draw the arch joints :—

At any point in the curve, say at E , drop a perpendicular on to the springing line, as F , make $B G$ equal $B F$, and from G draw line to E , which is a tangent to the curve, and erect the perpendicular $E H$, giving the arch joint required.

The other joints are described in the same manner.

Fig. 10.—Is another example of the Tudor arch, and is a parabolic curve.

Let $A B$ be the span and $C D$ the rise, erect a perpendicular at A and make it equal in height to half the rise, and proceed as in previous figure.

To draw the arch joints :—

At any point in the curve, say at E , draw the chord line $B D$ and bisect it in F ; join $F G$ cutting the curve in H , and from the point E draw line $E J$ parallel to $E F$, cutting $F G$ in J ; on the line $F G$ make $H K$ equal to $H J$, join $E K$ and draw $E L$ perpendicular to $K E$, thus giving the joint line required.

The other joints are described in a similar manner.

Fig. 11.—Shews a straight or flat arch, the joints radiating to a common centre.

On the right-hand half the joints are not continued through to soffit or top, but have a small portion squared on, thus relieving the acute angles of arch blocks, which are otherwise liable to fracture.

The springer on left hand has additional strength in having a square seating on skewback.

In flat arches a camber of an eighth of an inch in a foot to soffit is usually given to allow for any depression or settlement.

Fig. 12.—Is another example of the flat arch; the left-hand half has rebated or step joints, and the right-hand half has joggle joints. All these joints converge to a common centre.

Fig. 13.—In this figure a lintel with double joggle vertical joints is given.

Fig. 14.—Shews a lintel with curved joggle joints, and is an example not often met with.

The form of joint in figs. 12, 13 and 14 is a little wasteful of material; but where stone is plentiful and in small blocks, good lintels may be obtained. Many examples of these may be seen in our modern Gothic buildings.

Fig. 15.—Illustrates a window or door head with quadrant corners; the stretching-piece or key is in one stone, with arch-joints resting on the skewbacks.

Fig. 16.—Is another form of head, the square seating on each stone giving additional strength, and the joints converge to a common centre.

Fig. 17.—Shews three joints used in landings.

A is a joggle joint, commonly called He and She joggle. A tongue is cut slightly tapering on one edge, fitting into a corresponding groove worked in the other edge. Run in with cement it forms a strong and secure joint.

B is a rebated joint; this is sometimes undercut.

C is a bird's mouth joint. Grooves are roughly cut in on the edges of these joints opposite each other, and the cavities run with cement grout. Slate dowels are also laid longitudinally in the joint and run with cement.

ARCHES AND JOINTS

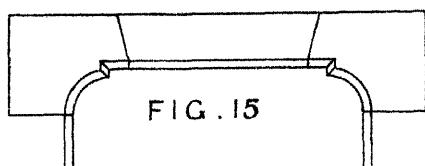
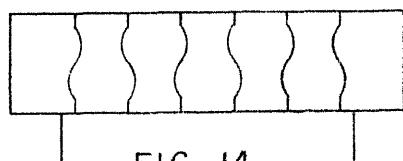
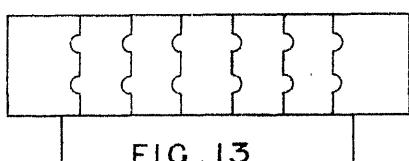
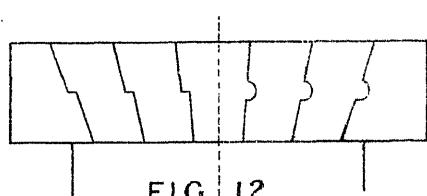
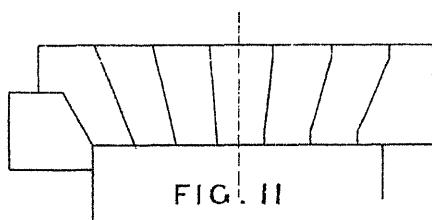
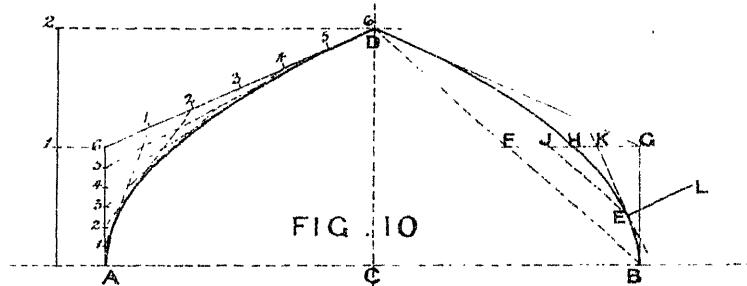
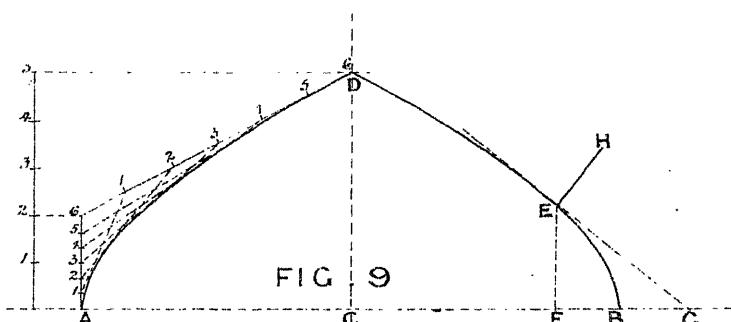


Fig. 18.—A horizontal lintel or architrave spanning an opening, with an apparent vertical joint, but concealing a secret arch joint.

This is used chiefly in colonnades, porticoes, &c., where stones of a sufficient length are not attainable, and sometimes also for convenience of hoisting and fixing.

An indent is formed the shape of the reverse of a wedge in joint of abutment, and a wedge-shape projection is cut in keystone fitting neatly into the indent.

This makes a good and secure joint without dowelling or cramping.

Fig. 19.—Shows sketch of weather or saddle joint in cornice.

This joint is made by leaving at each end of the stone a ridge or roll, the formation of which is generally left till after fixing. This roll effectually prevents the water running through the joint. The roll is not usually seen from the front, as the nose of cornice is continued straight through the joint, although it is also in some cases made a feature of.

This joint is used chiefly for cornices and window sills where there is a large projection.

A cross-section of the joint shows thus :



Fig. 20.—Exhibits a rebated joint in gable coping.

This joint is serviceable, inasmuch as it keeps the water out of the joint and the wall dry, although it is somewhat expensive.

Fig. 21.—An example of various bed joints in stone spires, being respectively—

- A.* A horizontal bed joint.
- B.* A bed joint at right angles to batter.
- C.* A rebated or stepped bed joint.
- D.* A joggle or tabled joint.

The bed joints of the stones are usually cut at right angles to the batter or face of the spire, as at *B*; but horizontal beds, as at *A*, are supposed not to involve so much thrust at the base. But for obviating any outward tendency, a chain or rod-bond united at the angles, and inserted in a cavity at the base of the spire, is sometimes used.

The two bed joints *C* and *D* are both a little wasteful of material, but for stability and strength these are by far the best form of joints.

A word may be said as to the thickness of the work; this will depend

ARCHES AND JOINTS

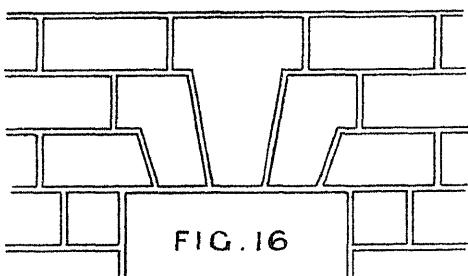


FIG. 16

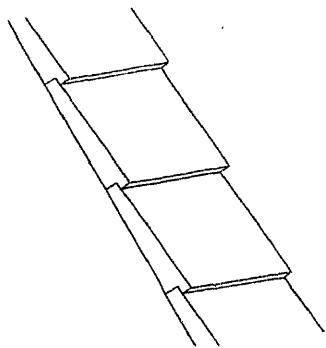


FIG. 20

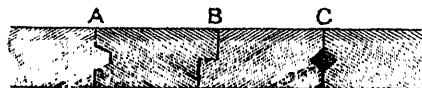


FIG. 17

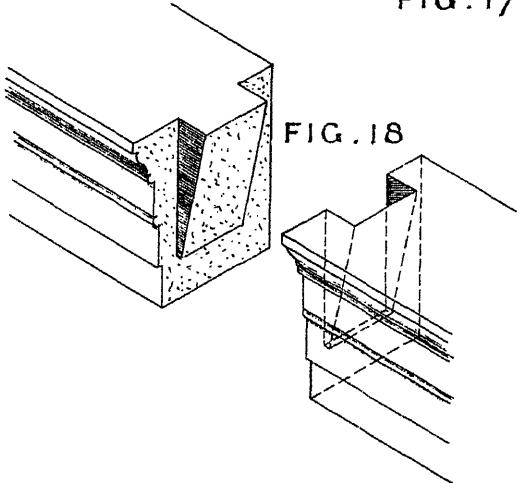


FIG. 18

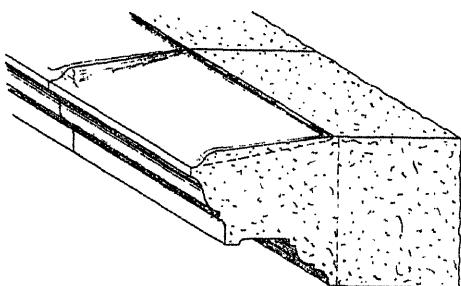


FIG. 19

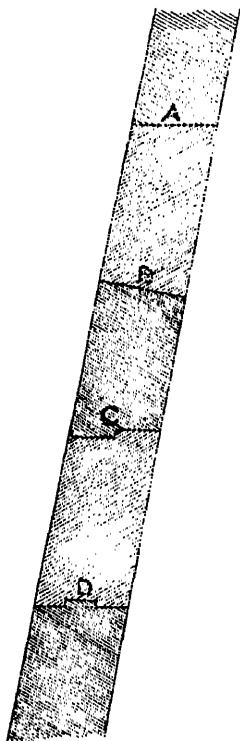


FIG. 21

chiefly on the height of the spire and the quality of the stone. From ten or twelve inches at the base, diminishing to six inches or even less at the top, may be generally considered sufficient.

The stone-work of the spire of Salisbury Cathedral (the spire, reckoning from the tower, being 204 feet in height), is two feet thick at the base, and gradually diminishes in thickness to about twenty feet above the tower, where it is reduced to nine inches, and is continued at that thickness to the capstone at the summit.

Fig. 22.—Gives plan of part of one course of stones in the Eddystone lighthouse. The stones are held in position by being dovetailed one into the other.

This form of joint is seldom used, except in works requiring great strength, such as sea-walls, breakwaters, &c. It is also an expensive joint, on account of the large amount of labour, and the waste of material.

Fig. 23.—Shews ashlar in courses with joggle joints.

This is a very unusual form of joint, and is used no doubt more for effect than utility. There is a waste of material and labour, and a better result may be obtained by the use of slate cramps. However, there are several examples of it in modern buildings in London.

Fig. 24.—A seating to sill, with a slate or copper dowel to prevent lateral motion. Mortices are cut opposite to each other in the two beds, and the dowel made secure by being run in with cement.

The dowel is a most useful adjunct in good and secure fixing.

Fig. 25.—*A* is a metal cramp for securing joints together. A chase or groove is cut in the stone of a sufficient width and depth, and at each end a mortice hole is cut to the exact size of inside of cramp, so that it fits tightly, and requires to be tapped into its place; it is then run with melted brimstone or cement.

The use of iron cramps and dowels in connection with stone is generally attended with some danger, on account of the iron rusting, which causes an increase in size, and subsequent fractures and discolouration of the stone. But if the iron is properly protected by galvanizing or japaning, the risk is reduced to a minimum.

The best metals for cramps, dowels, &c., are copper, gun metal, or brass, but these are expensive and are therefore not much used.

B is an example of a slate cramp also used for connecting joints

ARCHES AND JOINTS

FIG. 22

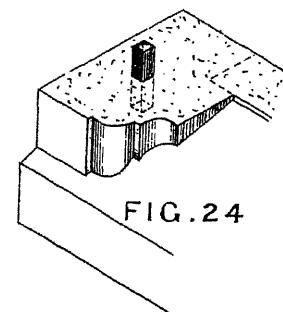
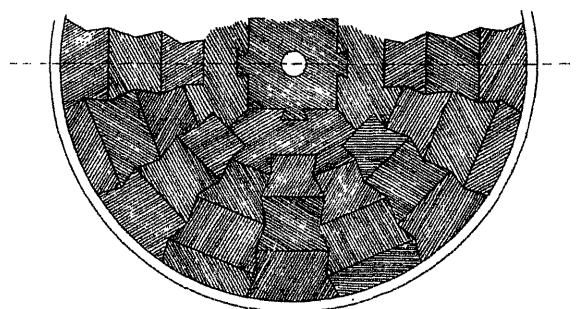


FIG. 23

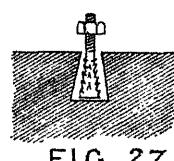
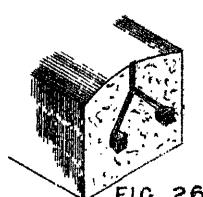
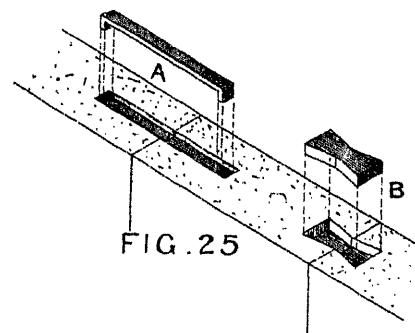
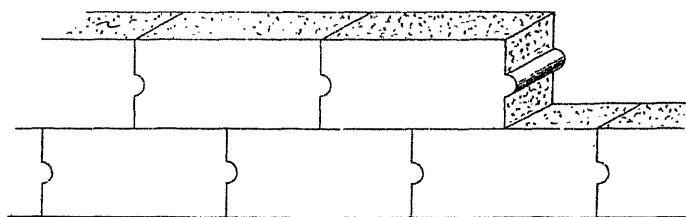


FIG. 27

together, and is an excellent and economical substitute for metal. It is made dovetail in shape, let in flush to the bed of the stone, and then run in with cement.

Fig. 26.—Shews a plugged or lead dowelled joint. This is chiefly used in copings, curbs, strings, arches, &c., and prevents the joint working loose or “drawing.”

Two holes, dovetail in shape, are sunk in the joints opposite each other and a small groove is cut from the top to each hole and run in with lead.

Slate dowels are sometimes used for this purpose, and run in with cement.

Fig. 27.—Shews a lewis, or holding down bolt, let in a dovetail hole and run in with lead.

PLATES IX., X., XI.—MASONRY DETAILS.

Fig. 1.—To form a PLANE SURFACE from a rough block, when the surface is of considerable size.

Four small cubes of beech, or any hard wood, about two inches square, wrought perfectly true, are used for this purpose, and are termed *boning pegs*.

Commence at the end of block by chiselling at each corner a sinking sufficiently low to take out any irregularities which from observation can be seen, and repeat the operation at the opposite end; place the pegs at each corner, and apply straight-edge on them as at *a b* and *c d*, sight through (or “bone,” as it is usually termed), and adjust sinkings until the bottom of straight-edges are out of winding and in one plane. This being done, work straight drafts from sinkings *a* to *b*, *c* to *d*, *b* to *c*, and from *d* to *a*, point off superfluous stone and dress to a finished face.

To prove that the face is a true plane, apply the straight-edge on the diagonals *a* to *c* and *b* to *d*; these should be perfectly straight, and the surface also in every part should coincide with the straight-edge.

The use of the “boning pegs” on large surfaces is obvious, as all that is necessary is to sink the small corners where the adjustment is required, instead of reworking a long draft each time.

When the surface to be formed is not too large, a draft may be sunk across at each end of the stone, and boned through with straight-edge, and the above operation repeated without the pegs.

With regard to beds and joints, these are worked to perfectly true and straight surfaces, and the chisel drafts round the margin should form sharp and straight arrises.

The point may be freely used in the centre of bed, but care must be taken not to work the bed hollow, because when the stone is bedded, there would be undue pressure on the outer edges, which would be liable to cause fracture of the stone.

Fig. 2.—To form a WINDING SURFACE.

For this purpose two rules or straight-edges are used, one having parallel edges, the other with divergent edges giving the amount of twist that is required. The distance apart at which the two rules are to be placed is generally defined by two light iron rods connecting them together.

Commence by working drafts across each end of block, and apply the rules as at *c d* and *e f*, and bone the upper edges of rules until they coincide. Work straight drafts on sides at *c e* and *d f*, dividing each end into an equal number of parts as *g h i*, and cut straight drafts through from *g* to *g*, *h* to *h*, and *i* to *i*. The remaining portion is now to be subdivided, and straight drafts worked through from corresponding point to point until the whole surface is finished. The drafts must not be worked parallel to sides, or a correct winding surface will not be formed.

Winding surfaces are used chiefly in skew arches, with spiral beds and joints, and in the beds of coping to curved wing walls, and also to the soffit of winders in stairs, an example of which will be given in the next section.

Fig. 3.—To form a CYLINDRICAL SURFACE.

Square the ends of block off to a plane bed or joint, and scribe in section mould of cylinder; mark the centre and diagonal lines on as *a b*, *c d*, *e f*, *g h*, at each end, care being taken to keep these lines each in the same plane, as the accuracy of the cylinder depends on their coinciding.

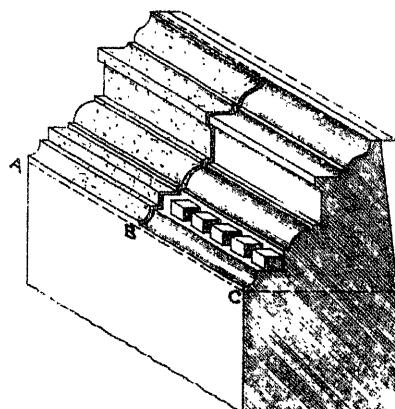
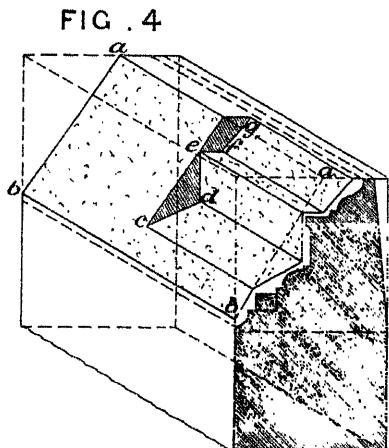
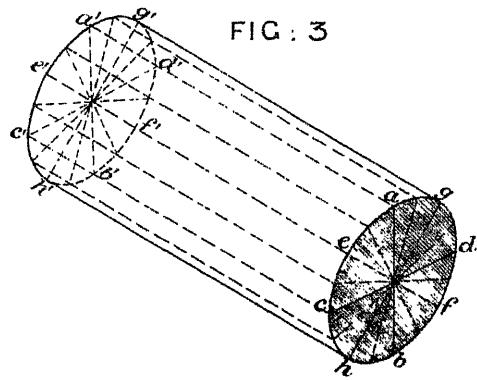
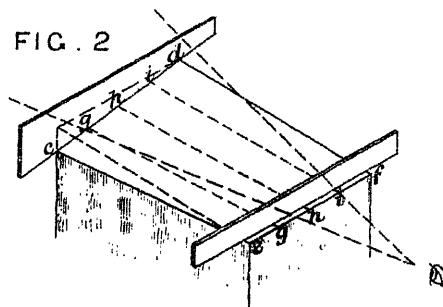
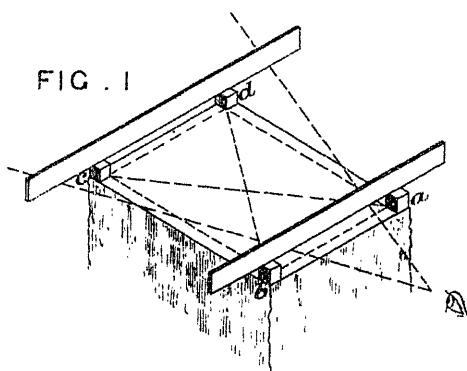
Point off superfluous stone roughly to near the surface, and chisel straight drafts from *a* to *a'*, *b* to *b'*, *c* to *c'*, &c.; divide the spaces from *a* to *e*, *a* to *g*, &c., into as many parts as are convenient, and work drafts through to corresponding divisions, until the whole surface is finished to a true cylindrical face.

Fig. 4.—To work a LENGTH of CORNICE out of a rectangular block of stone.

The beds, joints, and nosing being first worked, scribe in section mould on each joint, draw a line at pleasure close to the profile of moulding as at *a b*, forming a wedge-shape piece to be removed, which rough off with the punch right through the block, taking out smaller checks roughly as shewn at *c d e*, *e f g*.

Fig. 5.—The next process is shewn here, from *A* to *B*. This is to roughly chisel out the shape of mouldings to within about an eighth of an inch of the finished surface. This being done, clean through the mouldings, as shewn at *B* to *C*, by aid of round-nose and narrow chisels, and some-

MASONRY — DETAILS



times for extra finish smooth over with the boaster, applying the straight-edge frequently to test the accuracy of working; and lastly, cutting in the dentils.

This method of working applies to all other forms of mouldings.

Fig. 6.—Exhibits the various forms of dressing stone commonly used.

A shews a boasted or chiselled face, sometimes termed droved work. The face is finished with a boaster, and the strokes are generally regular and parallel to each other.

In hard grit stones this face is usually left as finished, and when, as in the case of a building, the whole of the ashlar and plain work is chiselled to the same angle of inclination, the effect is pleasing.

In softer stones a finished face is formed by rubbing the boasted face with sand and water, and removing all chisel marks; it is then called plain ashlar.

B shews ashlar with tooled face.

This is formed with a broad tool, or wide boaster, by a regular succession of strokes, parallel to each other, extending across the whole width of stone, and when finished shews a series of flutes or channels,

thus,  the size of flutes depending on the texture of the stone.

Considerable skill is required in tooling neatly, and the tooling is somewhat costly, the surface having first to be worked to a boasted face.

C shews ashlar with pick or pecked face, and tooled margin.

This is produced with a point, or in the case of granite with the pick, and can be worked to any degree of fineness.

D shews ashlar with punched rock face, and tooled margin.

This is similar to the last mentioned, but much coarser. In producing it, the punch is driven in almost vertical to the face until the stone bursts out, leaving a series of cavities. When regularly done it looks well, and is very effective, and for large work it gives the appearance of boldness and solidity.

E shews ashlar with broached face, and tooled margin.

This is produced with a point, which forms a furrow with rough ridges, and is worked across the stone to the required angle.

F shews ashlar with rusticated face, and tooled margin.

This is worked with small chisels and points, and sunk down about half an inch, leaving a plain narrow margin on face; the pattern is irregular, but easily adapted to any space.

G is a rebated or rustic quoin, with vermiculated face.

This is cut out with small chisels, and has the appearance of being worm-eaten.

Fig. 7.—To set out the ENTASIS, or SWELL, of a COLUMN.

Draw the centre line or axis, and set off the height of column, *L K*, and top and bottom diameters, *O P*, *N M*. Divide the column into four equal parts. The first part, to *A*, will be continued straight, and of the same diameter as at bottom. Divide the remaining three-fourths of column, from *A* to *K*, into any number of equal parts (in this example four), as at *B C D K*. At *A*, with radius *F* or *G*, draw the semicircle *F G*. Now project the top diameter *O P*, cutting the semicircle at *A A*, and divide the arc of semi *F A*, into four equal parts, as at 1, 2, 3, 4, answering to the number of divisions in column, and draw lines parallel to *F G*, as 1 1, 2 2, 3 3, 4 4; at *b b*, *c c*, *d d*, set off diameters 1 1, 2 2, and 3 3, respectively.

Bend a flexible rod to the points *O*, *d*, *c*, *b*, *F*, and draw the curved line, which repeat on opposite side from *P* to *G*, giving the required entasis.

Fig. 8.—Shews another method of setting out the entasis of columns, by a curve known as the conchoid of Nicomedes. This is preferable to the former method, and the result is more graceful and regular.

The height of column and bottom and top diameter being determined, draw centre line *H G*, and line *B J* at right angles to the same; set off the bottom semi-diameter, *A B*, from *D*, the extreme point of top diameter, cutting the centre line at *E*. Then from *D*, through *E*, produce the line to *F*, cutting base line at *C*, and from this point, *C*, as a centre, draw through the axis of column any number of lines, as *a*, *a*, *a*, &c., on each of which from the centre line towards the circumference set off the distance *A B*, as *a b*.

Through the points D , a , a , a , &c., draw the curve, by aid of a flexible rod, giving the entasis required.

This curve may be also struck with a trammel, which gives a continuous line, and is the most perfect of any system adopted.

The base perpendicular and hypotenuse being obtained by the preceding method, take three wood straight-edges, as $G H$, $B J$, and $D F$; fasten $G H$ and $J B$ together; at H plough a groove in middle of $G H$ from top to bottom, and at the point C on the rule $J B$ fix a pin; then on the rule $D F$ set off the distance $D E$, equal to $A B$, the bottom semi-diameter of column, and at the point E fix a button, whose head must be exactly fitted to the groove made in $G H$, in which it is to slide; and at the other extremity of the rule $D F$ cut a slot right through from F to L , the length being not less than the difference between $C E$ and $C B$, and of sufficient size to allow the slot to pass evenly the pin fixed at C .

The trammel being thus completed, place the rule $G H$ so that the middle of groove is directly over the centre line of column, move the rod $D F$ along the groove $G B$, and with its point D , on which is fixed a pencil, describe the continuous curve from D to A , thus giving the required entasis.

To diminish or enlarge a Section Mould.

Fig. 9.—Shews section of a cornice mould, which it is proposed to diminish to the height of a given line, $c d$, and the projection of the same diminishing in like proportion.

Draw the vertical line $a b$, and produce horizontal line of mouldings on to same; with $a b$ as base, erect an isosceles or equilateral triangle, $a o b$, and on this set off the given height, $c d$; from $a b$ draw the lines of mouldings converging to apex o , cutting the given line $c d$, which is proportionately divided by it.

For the projection: On line $g b$ draw the triangle $g h b$, and project vertical lines from points in the moulding, and draw converging lines to apex, h . The line $e f$ is obtained by finding a fourth proportional, namely, as $a b$ is to $c d$, so is $g b$ to $e f$. This may be solved by geometrical construction or by calculation. Transfer divisions from $c d$ and $e f$, Fig. 9, to $c d$ and $e f$, Fig. 10, produce the lines to intersections, and draw in the mouldings.

The above principle will apply to any description of mouldings, and any number of points in the members may be obtained similarly.

MASONRY-DETAILS

FIG. 9

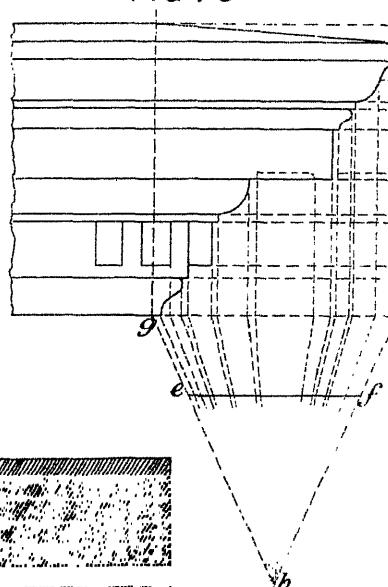
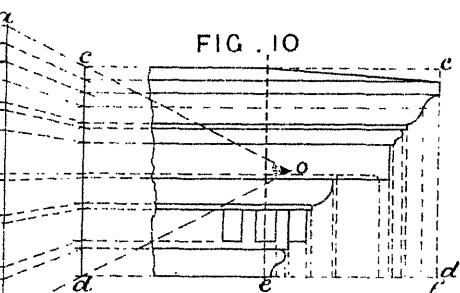
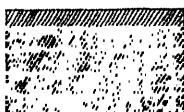


FIG. 10



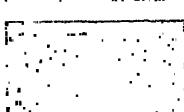
A



B



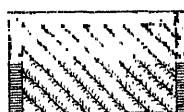
C



D



E



F



G

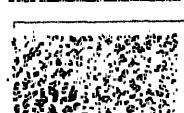


FIG. 6

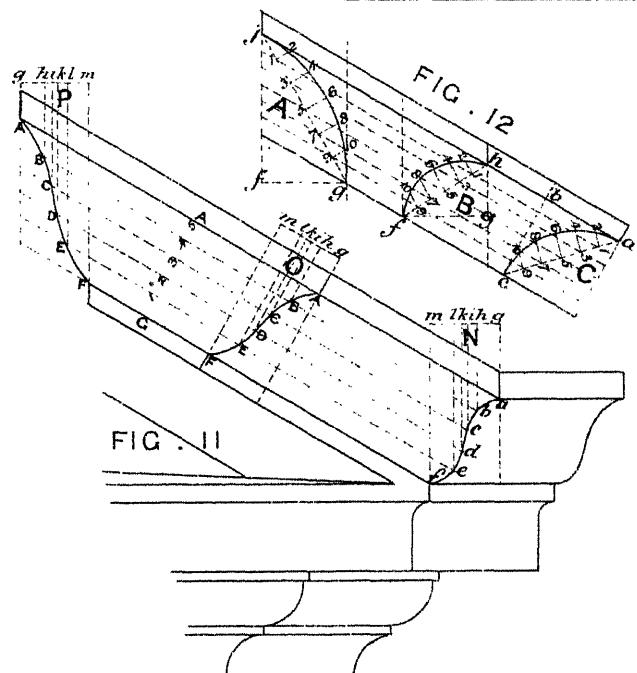
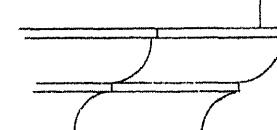


FIG. 11



13



13

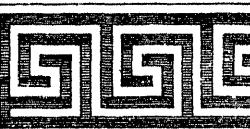


FIG. 14

MASONRY - DETAILS

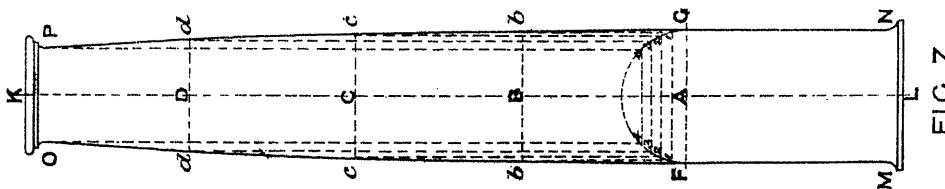
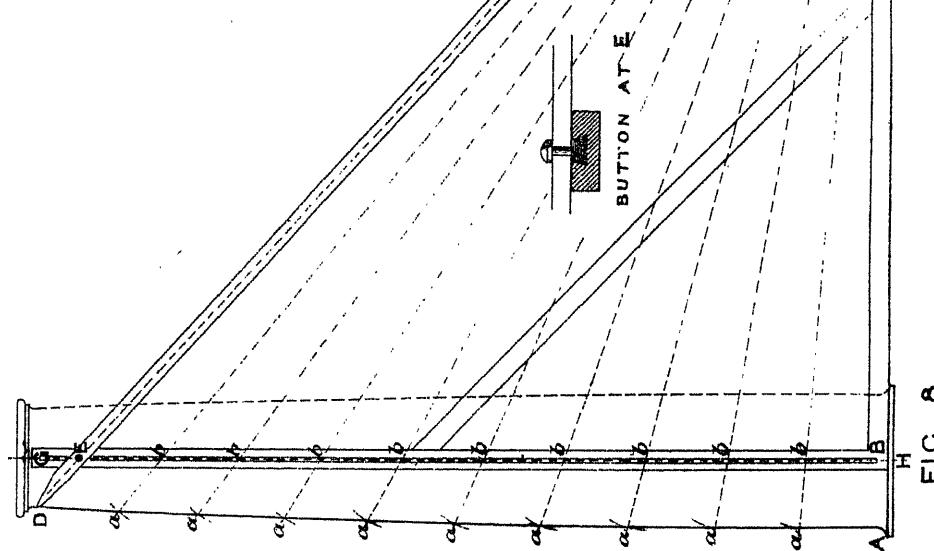
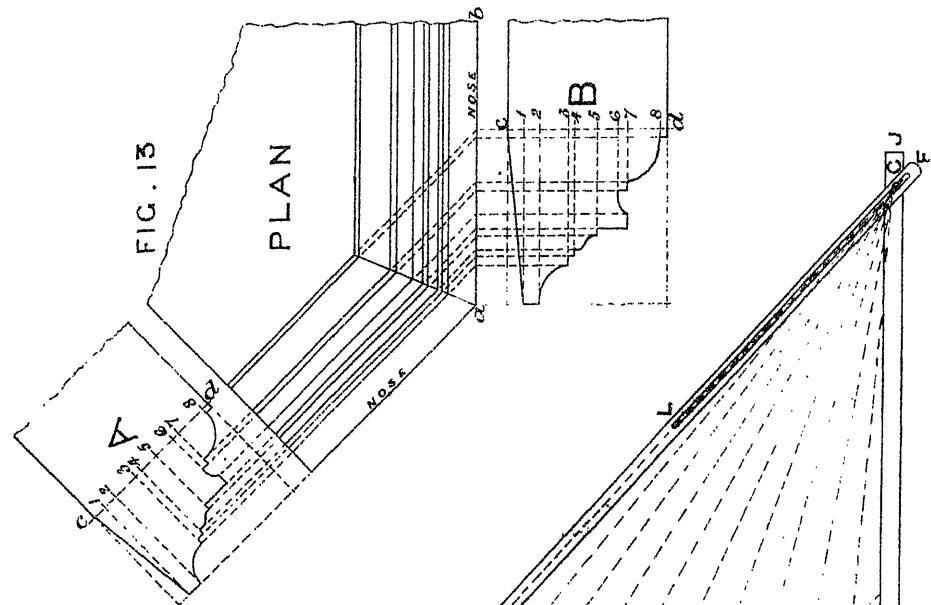


FIG. 6

FIG. 7

Raking Moulds.

[Raking is a term applied to such members of a building as are inclined from the level or horizontal, and frequently occur, especially in pediments, &c.]

Fig. 11.—To find the RAKING MOULD of the CYMA RECTA, or OGEE, in a pediment.

Let N be the given section of horizontal mould. Divide the distance from A to G into any number of parts, as 1, 2, 3, 4, 5, and draw lines through these points parallel to Aa , cutting N at b, c, d, e , and at a, b, c, d, e, f , erect perpendiculars, as g, h, i, k, l, m . At O draw a line parallel to the nosing, and transfer the distance g, h, i, k, l, m from N , and from these points project lines at right angles to the nosing, cutting raking lines, 1, 2, 3, 4, 5, at A, B, C, D, E, F . Through these points of intersection draw the section of cyma recta raking mould. This section will form a true mitre at N and P .

The section of ogee, as in that of a broken pediment at P , is obtained similarly.

Fig. 12.—To find the RAKING MOULD of a CAVETTO, or HOLLOW.

Let C be the given section. Draw a cord line from a to c , and divide it into any number of equal parts (in this example six), or divide the square line from c to b into the same number, and lines drawn through these divisions parallel to rake will equally divide all chord lines. Draw ordinates at chord lines a, c, fh , and gj , and set off 1 2, 3 4, 5 6, &c., and through the points 2, 4, 6, 8, at A and B , draw the curve giving the true sections.

All other sections of mouldings are obtained in a similar manner.

To produce a Stretching Mould, or Elongated Section of Square Mould.

Fig. 13.—Shews plan of octagonal angle, the square section of moulding being given at A .

To find the section to apply on line a, b , project lines of section A on to plan and produce them through to line a, b , and project these lines at right angles to the same. Set off the height and lines 1, 2, 3, 4, 5, &c., on d, c at A , and transfer to d, c on B , and produce them through. The

intersection of these lines will give points in the section, and for the contour of the mouldings, any number of points may be projected in the same manner, and the mould thus completed.

This section applies also to the mitre of a right angle.

Fig. 14.—Shews two examples of the Grecian fret, or key pattern.

These are produced by dividing the height into any number of equal parts, and the horizontal line into the same divisions; draw the lines through, intersecting each other, forming small squares, and then trace the pattern, the bands and sinkings being of equal width.

PLATES XII., XIII., XIV., XV.—STAIRCASES.

The *tread* of a step is the upper or horizontal surface, and the *riser* is the front vertical face or upright portion of the step. The *soffit* is the under surface, and in spandrel steps is inclined from the horizontal. The *nosing* is the front edge of the tread and riser, and is either square or moulded.

Flyers are straight steps with parallel edges.

Winders are steps with converging edges on tread, and parallel edges on riser, and generally a twisting surface on soffit.

For general purposes, the tread of a step should not be more than twelve inches, nor less than nine inches, and the rise of a step should not be more than seven inches, nor less than five and a half inches.

The proportion usually adopted, is any two numbers between the above sizes which, multiplied together, produce sixty-six: namely, a twelve-inch tread by a five and a half-inch rise equals sixty-six, or $11 \times 6 = 66$, and again $11\frac{1}{2} \times 5\frac{1}{2} = 66$. This, however, may be slightly modified—as, for instance, a ten-inch tread and a six and a half-inch rise equals sixty-five—but the rule may be relied upon as safe in working to.

A staircase easy of ascent, and in other respects desirable, is one in which all the steps are flyers, and having quarter or half-space landings.

Long straight flights with more than twelve steps before reaching a landing should be avoided.

Where there is a deficiency of room or space, winders have to be introduced; and these, if properly arranged, need not interfere with the ease of the ascent.

In setting out, for the purpose of making the moulds, the first point to be considered (the plan being satisfactory) is the width of the tread and the rise of the steps; these are best obtained by measuring the length and width of the well-hole, and the height from floor to floor, from the actual work if practicable, and then dividing out the dimensions thus obtained into the number of steps on deal rods, or it may be also found by calcula-

tion. The height rod is called the storey rod, and this and the other rods are afterwards used in the fixing of the stairs.

Fig. 1.—To set out a SPANDREL STEP MOULD.

Draw a line $F B$, and line $B C$ at right angles to same, and on $F B$ set off $A B$ the width of tread, and on $B C$ the height of rise. From A to C draw a diagonal line cutting tread and rise at their extremities, and draw parallel to it line $E D$ for soffit, of a sufficient depth proportioned to the strength of the stone, which in this example is put at two inches. For the back rebate, set off from A to F one and a quarter inches, and from F draw line square with soffit to E ; for the front rebate draw line from C to G square with the rise and set off one and a quarter inches, and from G draw line square with soffit to D ; thus forming a birdsmouth, the exact reverse of the back rebate.

Allow one-twelfth of an inch for joint, which cut off from the mould as shewn by double line at $C G D$.

A moulding or astragal nosing is added on to front of riser when necessary.

Fig. 2.—Shews plan of a stair generally considered to be a good type.

It starts with two curtail steps and four flyers reaching a quarter-space landing, then eleven more flyers, reaching a half-space landing, and five flyers to the top landing.

The setting out of this requires no explanation.

Fig. 3.—Shews part plan of stair with winders.

Fig. 4.—Is a development of the plan of stair shown in Fig. 3.

The stairs should be set out to full size, and on a large board or platform, and it may be here noted that the riser lines only are essential to the setting out, both on plan and section, the moulded nosing being seldom shewn.

Begin with the plan and draw the wall lines $C D E$, and lines $F G H$ for the quoin ends, draw centre line $A B$, and on this line from No. 13 to 20 divide out the winders equal to the width of tread of the flyers, dividing the quoin ends into the same number of parts.

These need not be equal in size, and a better result will be obtained if the ends are a little graduated from the flyers to the angle winder each

STAIRS

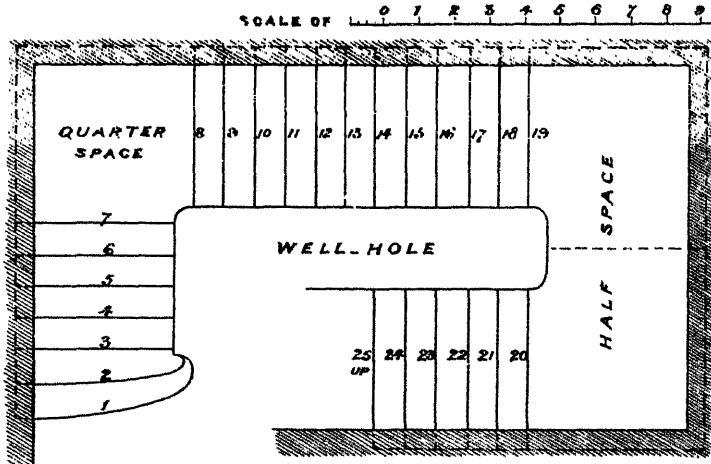
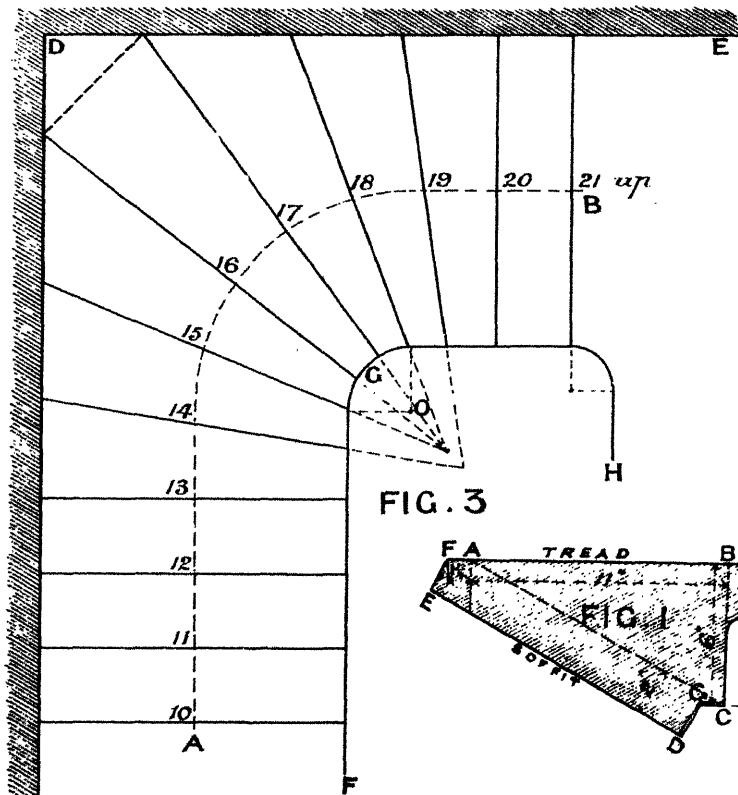


FIG. 2



SCALE TO FIG. 3.

way, in order to get a good tread and an easy line to the soffit and handrail.

The winders will not radiate from the centre of quadrant O , but at a distance outside of it, as shewn.

Another method is to draw the development of quoin end, and adjust the ends of steps upon this, until a good line for soffit is obtained, the riser lines are then transferred to plan.

To set up the development for quoin ends, draw parallel lines on board for the rise as given by storey rod, and begin at bottom by drawing No. 10 step, and then No. 11 and No. 12 steps. No. 13 is the first winder. Set off the exact size from riser to riser on plan and draw on board, proceeding in the same manner with No. 14. Nos. 15, 16, and 17 are segmental on plan. Set off the developed size of each respectively, following on with Nos. 18, 19, &c., till each is drawn, so that the distance from riser of No. 10 to riser of landing No. 21 equals the distance of quoin ends on plan, when unfolded or stretched out in a straight line.

For the development of the wall end, set out similarly to the preceding by taking the distance of each winder on the wall line of plan, and setting up the same on board. No. 16 is taken across the corner and not into the angle; with this exception the wall end is stretched out in a straight line.

The soffit has now to be considered. Begin by drawing an easy curved line, taking up with soffit of flyer No. 11 and finishing with soffit of landing No. 21, keeping the rebates about the same size as the ordinary steps; this it is not always possible to do, but the size of rebate is not of so much importance as that of having a good soffit line. The rebates to winders are in every instance of the same square section as the flyers, but in some cases may be less in depth or greater, according as the soffit line cuts through them. A small reverse should be made from the development for guidance in working each.

For drawing the soffit a flexible lath or rod is used, by means of which an easy and graceful line is obtained.

Fig. 5.—The bed moulds for winders are made of deal laths about two inches wide by half an inch thick, nailed together as shewn in sketch. The mould is scribed on the tread of the stone to be worked, allowance being made for the back rebate, and also for the tailing into wall, both of these dimensions being figured on the mould.

Fig. 6.—Shews a well-hole mould, usually made of sheet zinc, used for guidance in drawing the segmental quoin ends.

STAIRS

SCALE OF 1 INCH = 5 FEET

FIG. 4

DEVELOPMENT OF QUOIN END AND WALL END

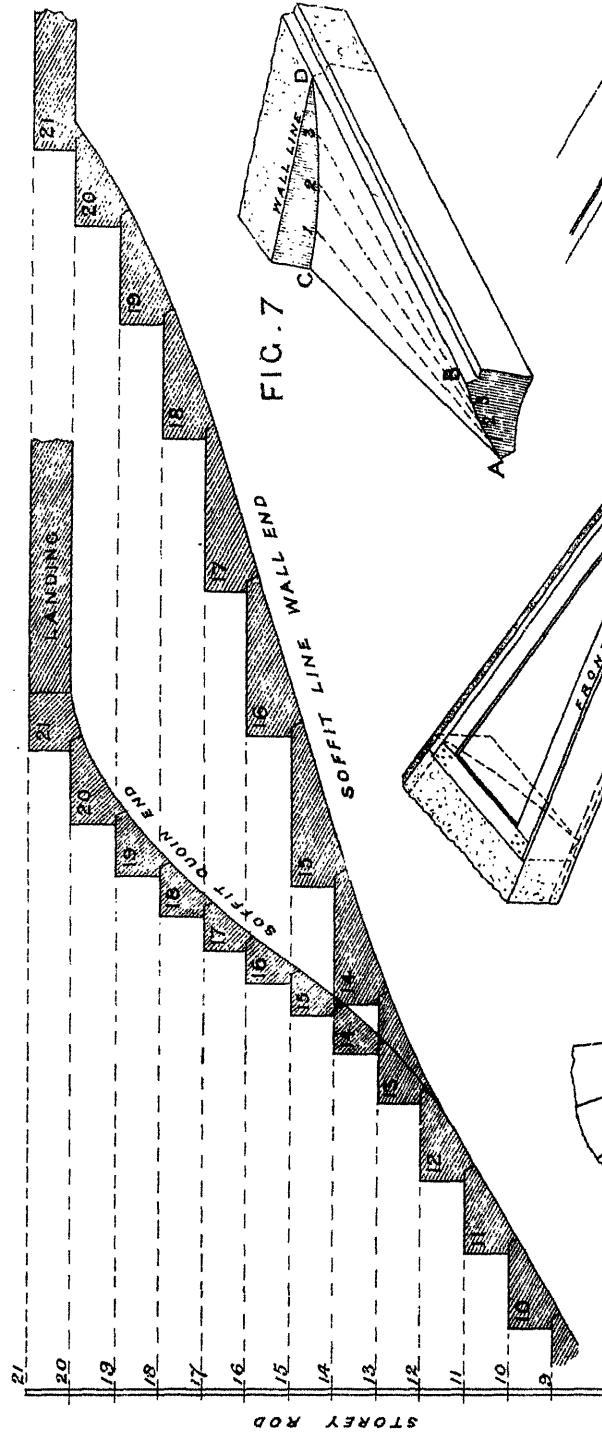


FIG. 7

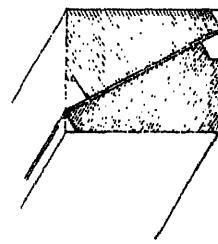
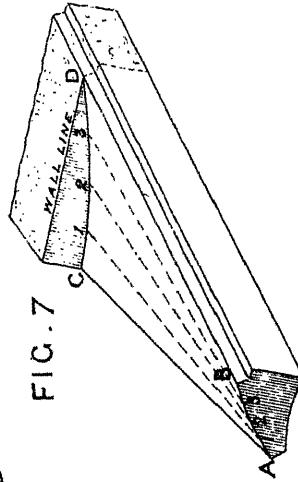


FIG. 17

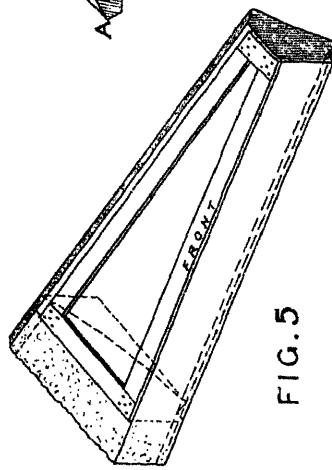


FIG. 5

WELL-HOLE
MOULD

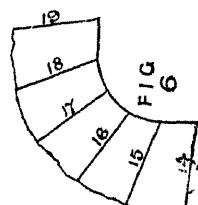


FIG. 6

Fig. 7.—Shews sketch of soffit of winder.

The working of the winder is plain straightforward work with the exception of the soffit, which is a twisted or warped surface.

Cut in draft as *A B* on quoin end and sink draft to templet at wall end as *C D*. Point off superfluous waste and divide drafts *A B* on quoin end, and *C D* at wall end, into four equal parts, as 1, 2, 3; work straight drafts from 1 to 1, 2 to 2, and 3 to 3; these are again to be subdivided and straight drafts worked to corresponding divisions at each end, until the whole soffit is finished to a true winding surface.

The square seating at wall end is left on for a good fixing into wall.

A winding stair with moulded nosing is worked in precisely the same manner as the foregoing, the only difference being in the nosing, the projection of which is an addition to the plain riser, the riser lines, rebates and soffits being in every case identical.

A point which should not be lost sight of in setting out stairs, is to see that sufficient head room is allowed; this should not be less than six feet six inches from nose of steps to soffit of flight over,—that is to say, the soffit line of flight over should not cut below an arc described by a radius of six feet six inches, taken from the nose of either of the steps beneath.

Fig. 8.—Shews the plan of a winding staircase in a circular well, supported by a solid newel in the centre, the newel being worked on each step.

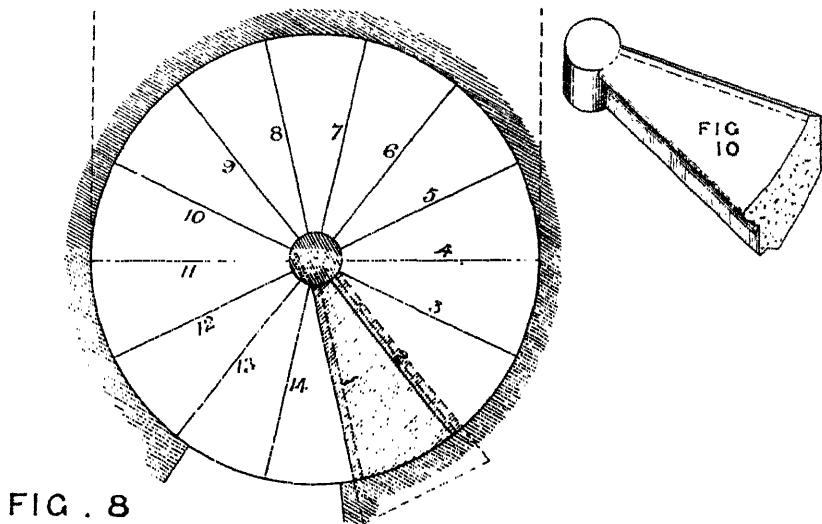
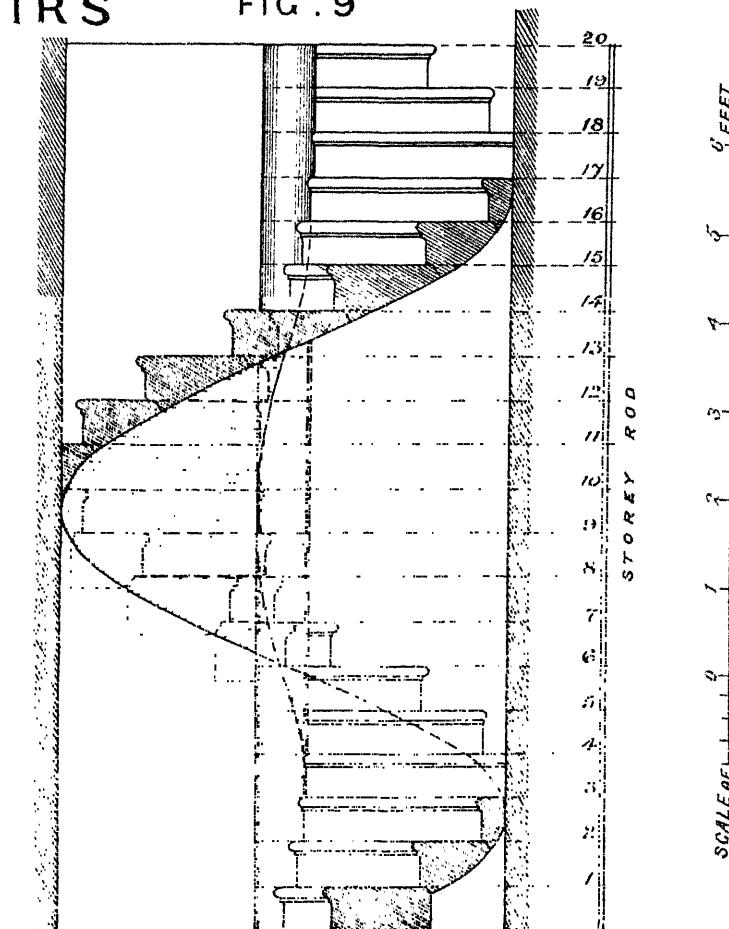
Fig. 9.—Is a sectional elevation of the winding staircase shown in Fig. 8.

It may be known to most of our readers, that if a piece of paper of the shape of a right-angled triangle be wound round a cylinder, the hypotenuse (or long side of the triangle) will generate a curve winding round the cylinder in the form of a spiral. This curve is called the helix.

The soffit line of the stairs winding round the well, and line winding round the newel, is the helix, and the soffit contained between these lines forms a true helical plane; the development therefore of each end of the step is a straight line on the soffit, so that no setting up on section is required. The plan must be laid down on the board full size, the treads being divided out equally, and each step being similar and alike, one mould

STAIRS

FIG. 9



will do for the whole. The starting step is not generally worked on the soffit, but is kept solid.

The hatched line on Fig. 8 shews the extreme size of the bed mould of each winder.

The method of working the soffits will be similar to that described in Fig. 7.

Fig. 10.—Shews a sketch of one of the winders, the newel forming a portion of each.

Fig. 11.—Shews part plan of a circular stair, having an open newel or central well; this stair, like the preceding Figs. 8 and 9, is an example of the helix, the soffit being a helical plane.

Fig. 12.—Is development of part of the circular stair of Fig. 11, shewing quoin and wall end, the lines of soffit to each being straight.

The student who has worked out the previous examples of stairs, will not, it is presumed, require any further instruction on the setting out and working.

Figs. 13 and 14 are elevations of quoin ends, and sections of two forms of bracketed stairs suitable for good buildings, such as hotels, mansions, clubs, &c.

Fig. 15.—Is a section of solid square steps, suitable for warehouses, workshops, &c., where great strength is required.

Fig. 16.—Shews section of a simple form of steps, consisting of treads and risers in separate pieces, worked out of two inch or two and a half-inch stuff. These are chiefly used for back stairs, area steps, &c., and are inexpensive in construction.

Fig. 17.—Shews method of sawing spandrel steps, one out of the other, so as to economise stone.

The treads of winders are also sawn in a similar manner.

STAIRS

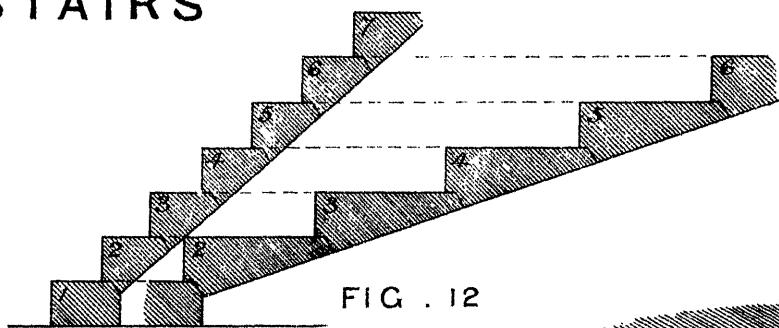


FIG . 12

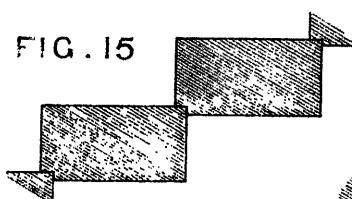


FIG . 15

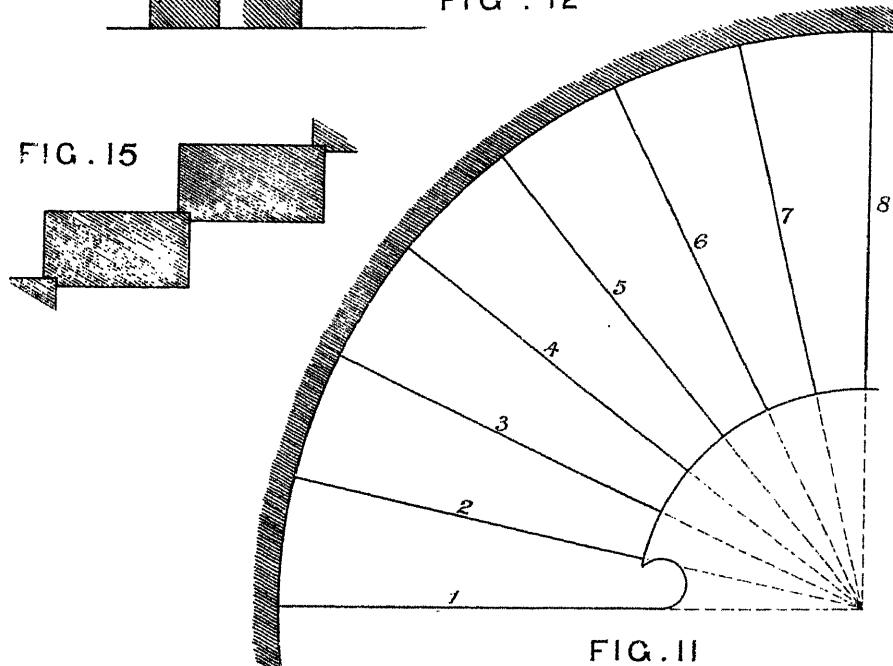


FIG . 11

FIG . 13

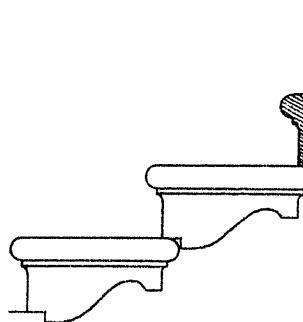
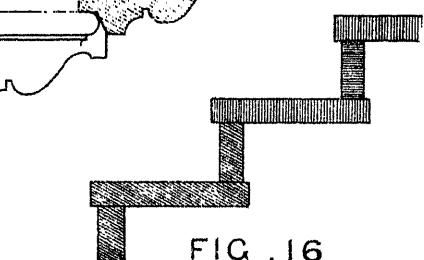
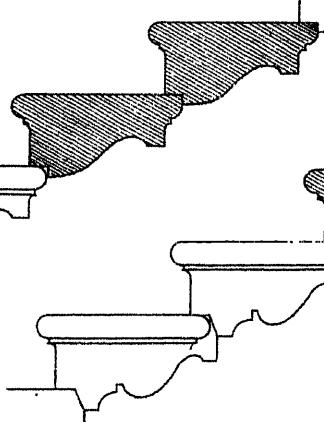


FIG . 14

0 3 6 9 12
1 FOOT

SCALE TO FIG . 13.14.15.16.

FIG . 16

SCALE TO FIG . 11 & 12
9 FEET

PLATES XVI., XVII., XVIII., XIX.—CIRCULAR WORK (RAMP AND TWIST).

Fig. 1.—Shews plan of part of a TERRACE STAIR, with BALUSTRADE following the inclination or rake of steps. The balustrade being circular on plan, it necessitates a certain amount of twist in its working.

[The method here adopted is not, perhaps, the most economical as regards material; but it is comprehensible, and more true in form when worked than with a complication of moulds and bevels, and the material is more than saved in the labour of working.]

Begin by laying down the plan full size on a large board or platform, carefully dividing the space for balusters equally.

Fig. 2.—Set up the elevation to developed line of convex or outside face of plinth—that is to say, the line *A B C* on plan (Fig. 1), when stretched out or unfolded in a straight line, is equal to or of the same length as the horizontal line *A B C*. The line of inclination will be a helical line, as the steps are of equal tread and rise; therefore the plinth starts with a straight line parallel to the nose of steps.

On elevation set off the joints (convenient to the size of stone) for the plinth and capping at right angles to the line of rake.

Fig. 3.—Set up the elevation to developed line of concave or inside face of plinth, and set off the joints which are to coincide with the outside joints. To obtain these, transfer the joints from the elevation (Fig. 2) of outside face to the plan (Fig. 1), and produce the joint lines through to inside face by the lines radiating from centre, and re-transfer to the inside elevation.

The method of drawing the section of steps is shown by the dotted lines and the notation, this being similar to the plan.

BALUSTRADE RAMP & TWIST

FIG. 1

PLAN

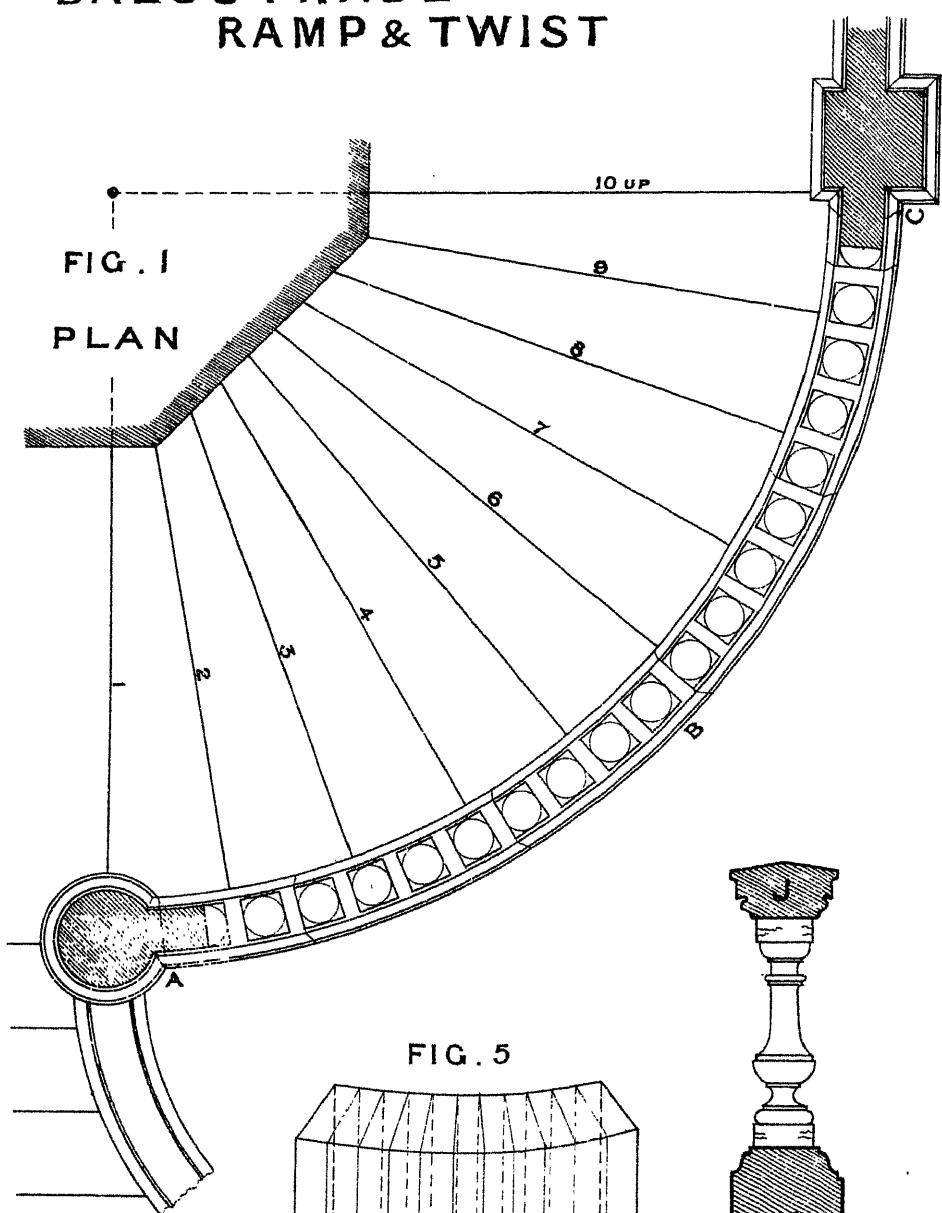


FIG. 5

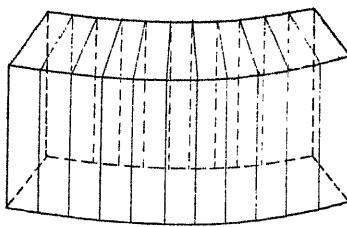
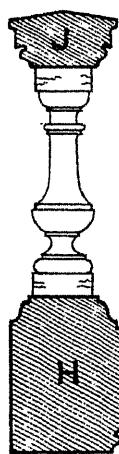
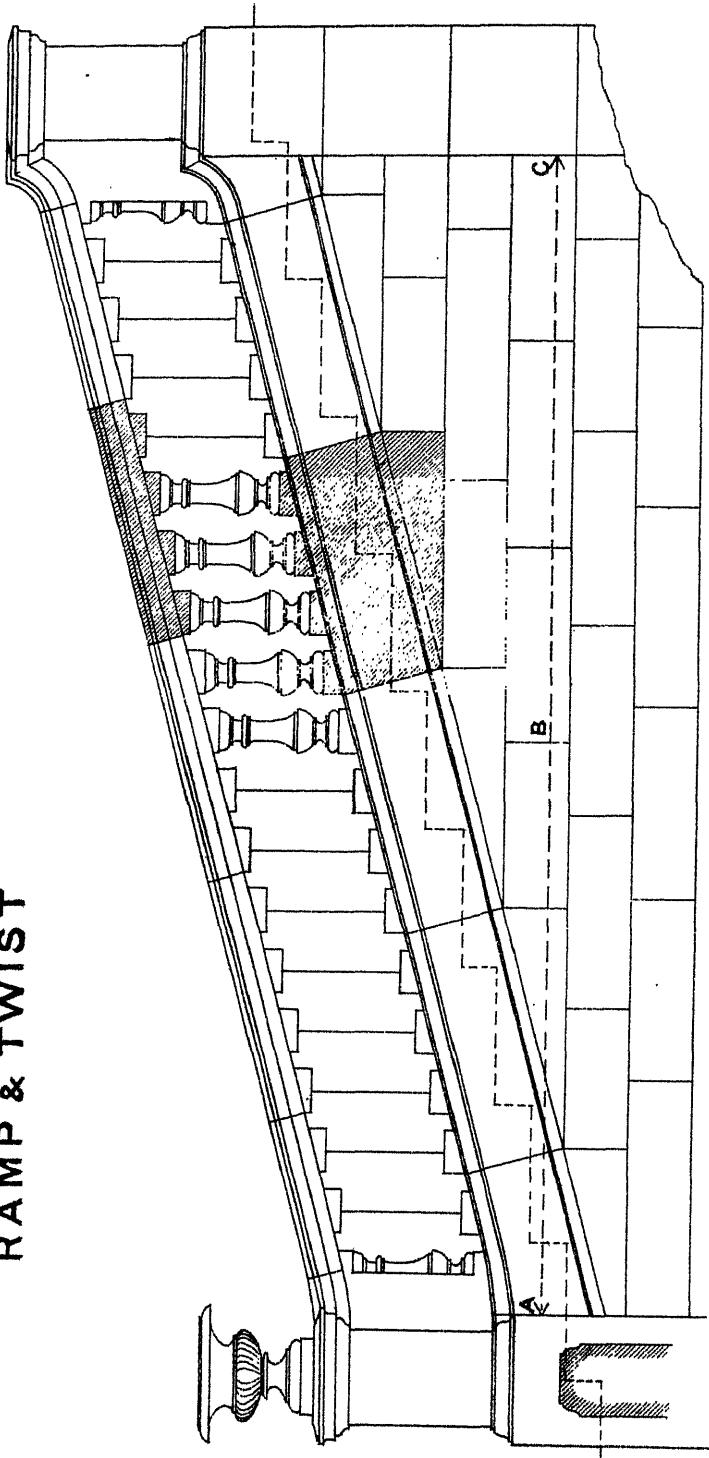


FIG. 11



0 1 2 3 4 5 6 FT.
SCALE to FIG. 1, 2 & 3.

BALUSTRADE
RAMPS & TWIST



— FIG. 2 —
DEVELOPMENT OF OUTSIDE ELEVATION —

SCALE OF 1 2 3 4 5 6 FT.

For the purpose of illustrating the making of the moulds and the working of the stones a plinth block and length of capping are taken, as shewn by hatched lines on Figs. 2 and 3. The details are given to a larger scale.

To work the Plinth Block.

The block of stone required to work the plinth block will be rectangular in shape, of the extreme length of the bed mould; and the width will be equal to the distance across the chord line, and the height will be that of the face moulds.

Fig. 4.—*A* Shews bed mould of the plinth.

B Shews face mould of convex or outside face.

C Shews face mould of concave or inside face.

Begin by working the bottom bed to a true plane; then work the top bed parallel to it as a surface of operation, and taken to the height of the face mould. Scribe the bed mould in on each bed, care being taken to bone the points through so that the moulds are perfectly out of twist; proceed to work the concave and convex surfaces. For guidance in working this to a true form radiating lines are marked on the beds taken from the mould, and the straight edge is applied on the face to drafts coinciding with these. At this stage the stone is a true segment of a hollow cylinder, as shewn in Fig. 5. Now apply face mould *B* (Fig. 4), to convex face, and face mould *C* (Fig. 4), to concave face, and scribe them in to their respective shapes; work the joints through, and scribe in the section mould *H* (Fig. 11).

The top bed, or surface of operation, is now done with, except at the high corner which forms the bed of the baluster seating. Point off the superfluous waste down to the top of the other baluster seatings, and clean through the beds and sides of these from outside to inside face, as shewn by sketch Fig. 6.

Next gauge the distance taken from the bed or section mould of seating of baluster to the convex and concave faces, and work the same, thus completing the baluster plinths.

For guidance in working the ogee raking mouldings, a bending strip or thin lath, and one or two small reverses cut to section of moulding, will be all that is required, and the stone is finished as in sketch (Fig. 7).

Each of the other plinth stones are worked similarly.

BALUSTRADE
RAMP & TWIST

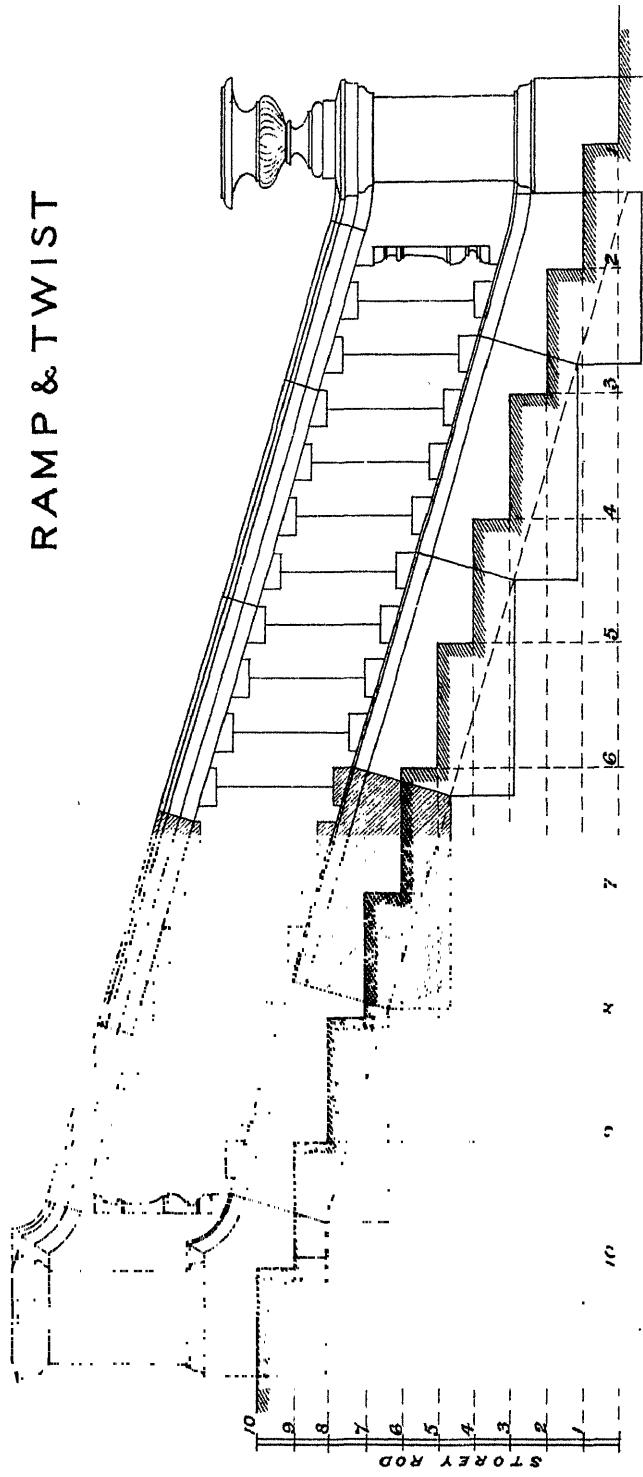


FIG. 3
DEVELOPMENT OF INSIDE ELEVATION

SCALE LINE 0 1 2 3 4 5 6 FT.

FIG. 4

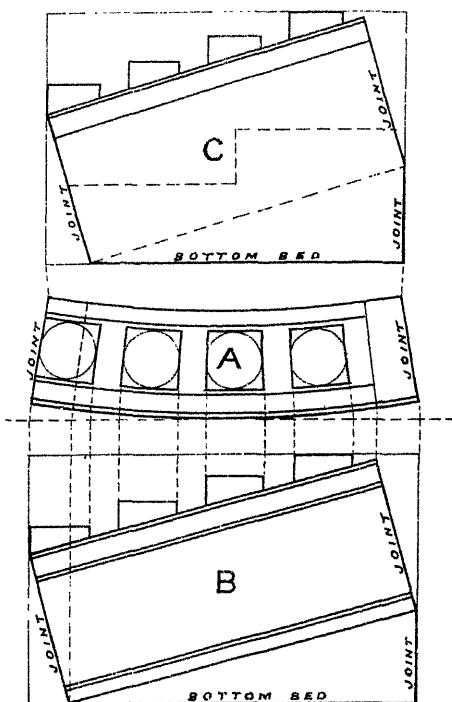


FIG. 8

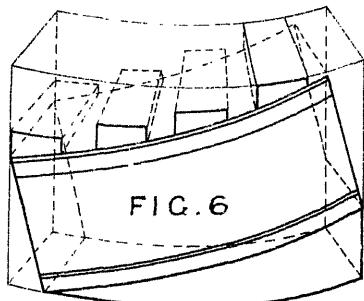
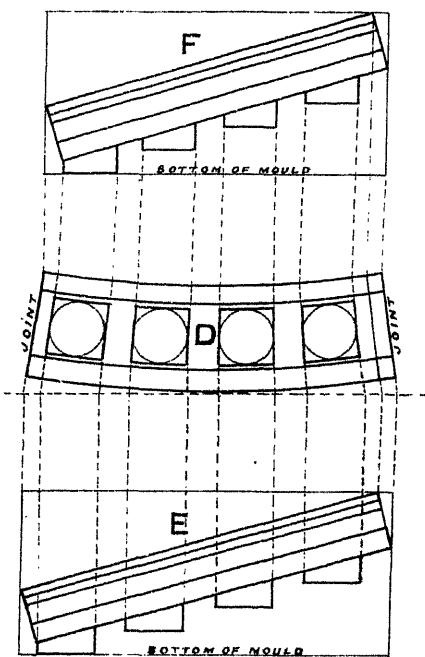


FIG. 9

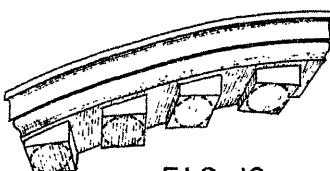
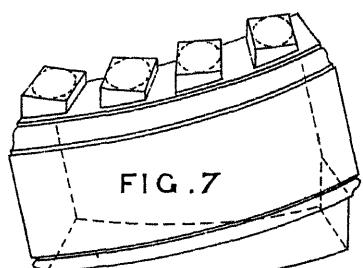
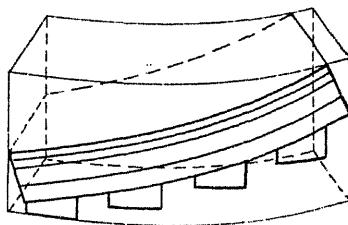


FIG. 10

SKETCH OF FINISHED
PLINTH

SCALE FOR DETAILS
0 1 2 3 FT

To work the Length of Capping.

Fig. 8.—D Shews bed mould of the capping.

E Shews face mould of convex face.

F Shews face mould of concave face.

This stone is worked in precisely the same manner as the plinth—namely, by working first a segment of a cylinder to the shape of the bed mould and to the height of the face mould, as in sketch (Fig. 5). Then apply face moulds E and F respectively to the convex and concave faces, and scribe them in. Work off the joints, and scribe in section mould J (Fig. 11); next point off the superfluous waste, and work the baluster seatings as before described. Trammel lines for raking mouldings and work them through, assisted by a bending strip and reverses, and finish by working off the saddle-back weathering.

The small seating or plinth of baluster is worked on the plinth and the capping, in order that a level bed may be obtained in fixing the baluster.

Each of the other lengths of capping are worked in a similar manner to the foregoing.

Fig. 10.—Is sketch of length of capping finished; this is slightly tilted up, so as to shew the baluster plinths.

Fig. 11.—Shews section of the plinth, capping, and baluster.

PLATES XX., XXI., XXII., XXIII.—ARCHES.

CIRCULAR ON PLAN, OR ARCHES OF DOUBLE CURVATURE.

To describe the construction of a SEMI-CIRCULAR ARCH in a CYLINDRICAL WALL, the development of which on convex or outside face is a semi-circle, and on concave or inside face is a semi-ellipse, the soffit radiating to a centre at springing, and the crown of the arch level or at right angles to the vertical face of the wall.

Fig. 1.—Shews plan of the arch, *B C D* being the opening, the arch radiating to *O*, the centre of the cylinder.

To set up the Elevation on the Development for the Face Moulds.

Fig. 2.—Develop the segment *A B C* of convex face (Fig. 1), setting out the length on springing line as *A B C* from *C* as the centre; erect a perpendicular as centre line, and describe with *C B* as radius half of the semi-circle. Set off the joints radiating to the centre *C* corresponding to the number of arch joints required, which in this example is seven. The square bonding *d a, f b, g c* of vertical and horizontal joints may be of varied sizes. The radiating joints (here shewn) are made equal in length from the soffit, and for this purpose from the centre *C* describe a quadrant, cutting the joints at *a b c*.

To find the Development of Concave Face.

Fig. 3.—Divide the quadrant *B K* (Fig. 2), into any number of equal parts—in this example seven—and draw the ordinates 1, 2, 3, 4, 5, 6, projecting the same on to the springing line, and transfer these to the segment line *B C* on plan (Fig. 1) as 1, 2, 3, 4, 5, 6, and from these points draw radiating lines from the centre *O*, cutting the segment *B' C'* at 1', 2', 3', 4', 5', 6'; draw the developed length of *B' C'* on springing line (which is also equal to *C' D'* and is half of the inside face) from *C* to *D'*; transfer 1', 2', 3', 4',

5', 6' from Fig. 1, and draw the ordinates of equal height to those of Fig. 2, cutting Fig. 3 at 1", 2", 3", 4", &c., through the points 1", 2", 3", 4", &c.; draw the half of semi-ellipse, which gives the curve of the arris to the soffit.

The length of the joints in Fig. 3 is determined in the same manner as in Fig. 2—namely, by means of ordinates. One joint is here given as an example :

From A No. 2 A (Fig. 2) drop a perpendicular cutting the springing line at $2 C$; and from $2 C$ to 2 transfer to $2 C$ and 2 on the segment line of plan (Fig. 1), and draw radiating lines from $2 C$ to the centre O , cutting the segment $A' C'$ at $2 d$; transfer the distance from $2 d$ to $2'$ on to the springing line (Fig. 3). Set up ordinate and make equal in height to a on Fig. 2, and from $2 A$ to A' (Fig. 3) draw joint line, which also radiates from the centre C .

The moulds required for working each arch block are a bed mould and two face moulds (one to the convex and one to the concave face); these are already set out on plan and in developed elevations, but now require separating.

As an example, No. 1 A (Fig. 2) is the springer. For the bed mould take $A B 2$ and $A' B' 2'$ from plan (Fig. 1), and transfer to $1 C$ (Fig. 4).

The dotted line $B B'$ shews the line of the soffit on the bottom bed, the line $a a'$ the line of the arch joint on the top bed, $A A'$ the line of radiating vertical joint, and $2 2'$ the line of arris of the arch joint. This gives the plan of a segment of a hollow cylinder to the extreme size of the stone.

No. 1 A (Fig. 4) is the face mould for convex face, No. 1 B (Fig. 4) is the face mould for concave face, and both of these are transferred from $1 A$ and $1 B$ (Figs. 2 and 3) with the addition of the square line $2 2$ and $2' 2'$.

The stone for the arch block should be large enough to work the bed mould square through; if there is a “wandy” corner in the rough block, this may be arranged for in the corner where the stone has to be cut away for the soffit or the top joint.

Work the two beds bottom and top parallel to each other and of the height of the face mould, scribe in the bed mould No. 1 C on both beds (to be correct this should be boned in), the vertical joint $A d$ being at right angles to the bed. Next work the convex and concave faces through, and also the radiating joint $A A'$, the block at this stage being a portion of a hollow cylinder similar to sketch (Fig. 7).

ARCS CIRCULAR ON PLAN

DEVELOPMENTS

— HALF CONVEX — HALF CONCAVE —
 (OUTSIDE) (INSIDE)

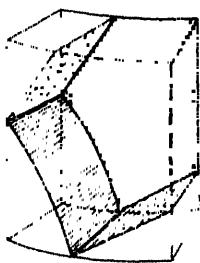
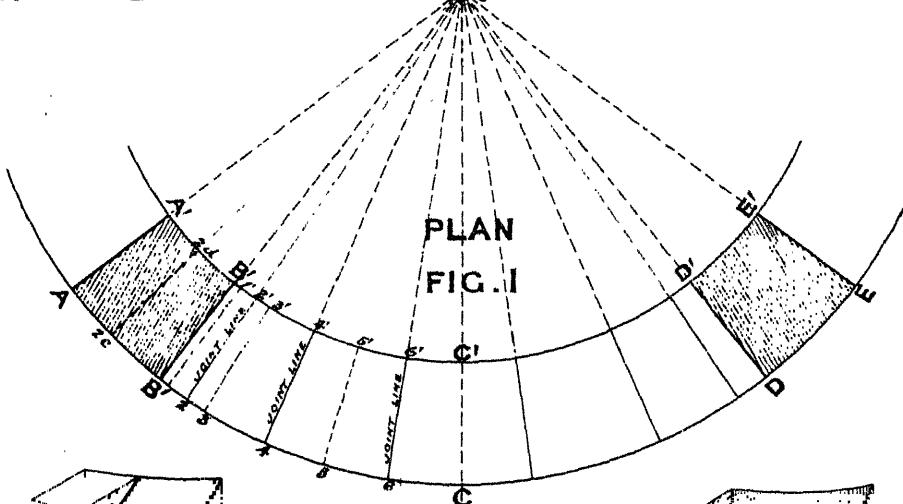
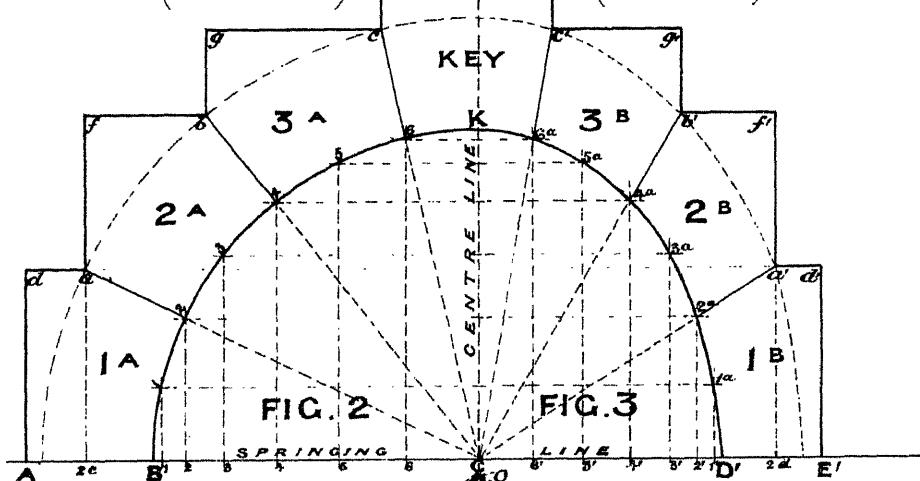


FIG. 8

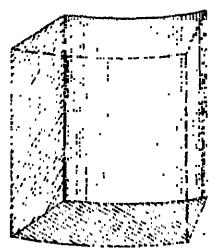


FIG. 7

Now scribe in the face moulds 1 A on the convex and 1 B on the concave faces (Fig. 4); next work the arch joint *a e* through (this will have a slight twist); and, lastly, for the soffit cut in a draft *B e* on convex and *B' e'* on concave faces, and work the surface through, thus completing the springer.

It may be observed that the soffit is a winding or warped surface, and it will be worked similar to the soffit of winder step, as previously described on page 38.

To work the Second Arch Stone, No. 2 A (Fig. 2).

For the bed mould 2 C (Fig. 5), project the extreme points *a* and 4, No. 2 A (Fig. 2) on to springing line; transfer these to the segment line *A C* on the plan (Fig. 1). This gives from 2 C to 4 and 2 *d* to 4', which encloses the bed mould; *a a'* is the vertical joint and arris of the arch joint *a 2*, the dotted line *2 2 a* is the horizontal line of the joint on soffit at bottom, and the line *b b'* is the arris at the top of arch joint, 4 4*a* is the bottom arris of the top joint to soffit.

No. 2 A (Fig. 5), is the face mould for the convex face, and No. 2 B (Fig. 5) is the face mould for the concave face; both of these are transferred from 2 A and 2 B (Figs. 2 and 3), with the addition of the square line 4 *b*, 4 C, and 4 1, 4 2.

Work the top bed first *f b*, 4 *b*, and take the bottom bed *a 2*, 4 C parallel to the top and of the height of the face mould (this is a surface of operation, all being cut away except arris *2 2 a*, which must be kept true across the bed). Scribe the bed mould No. 2 C (Fig. 5) on both beds. Now work the two faces convex and concave through, and the radiating joint *a a'* square with the top bed, bringing it again into the shape of a portion of hollow cylinder, as in sketch (Fig. 7).

Scribe the face mould 2 A on the convex and 2 B (Fig. 5) on concave faces. Work the arch joints *a 2* and *b 4*, and for the soffit cut in the draft 2 4 on the convex and 2 *a*, 4 *a* on concave faces, and work through as previously described.

The other arch stone 3 A and keystone are worked in a similar manner, the general principles of working being the same.

Note.—The radiating joint lines on the developments (Figs. 2 and 3) to be geometrically correct should not be straight, being slightly curved. This is apparent on cutting a cylinder by a right line obliquely, the development of which is a compound curve; but in this case the curve is so

FIG. 4

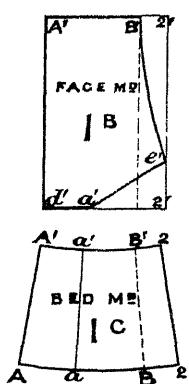


FIG. 5

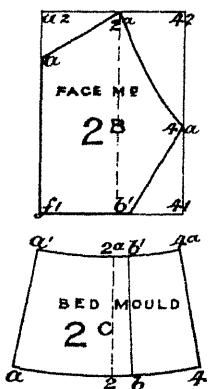


FIG. 6

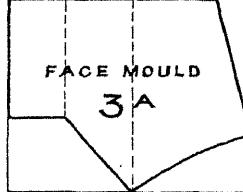
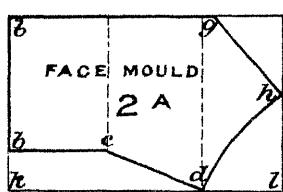
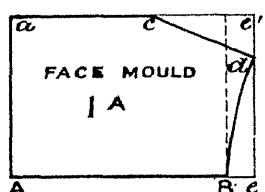
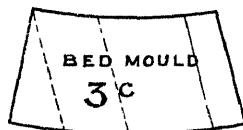
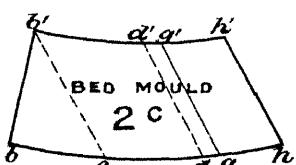
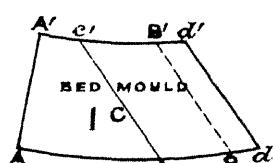
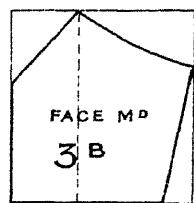
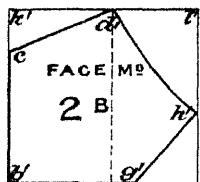
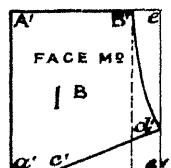
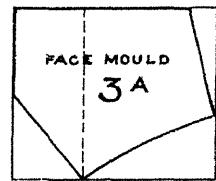
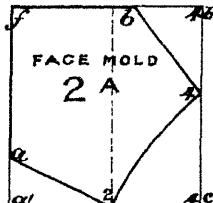
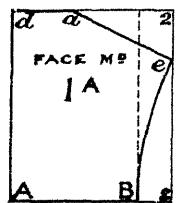
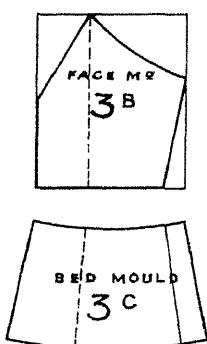


FIG. 12

FIG. 13

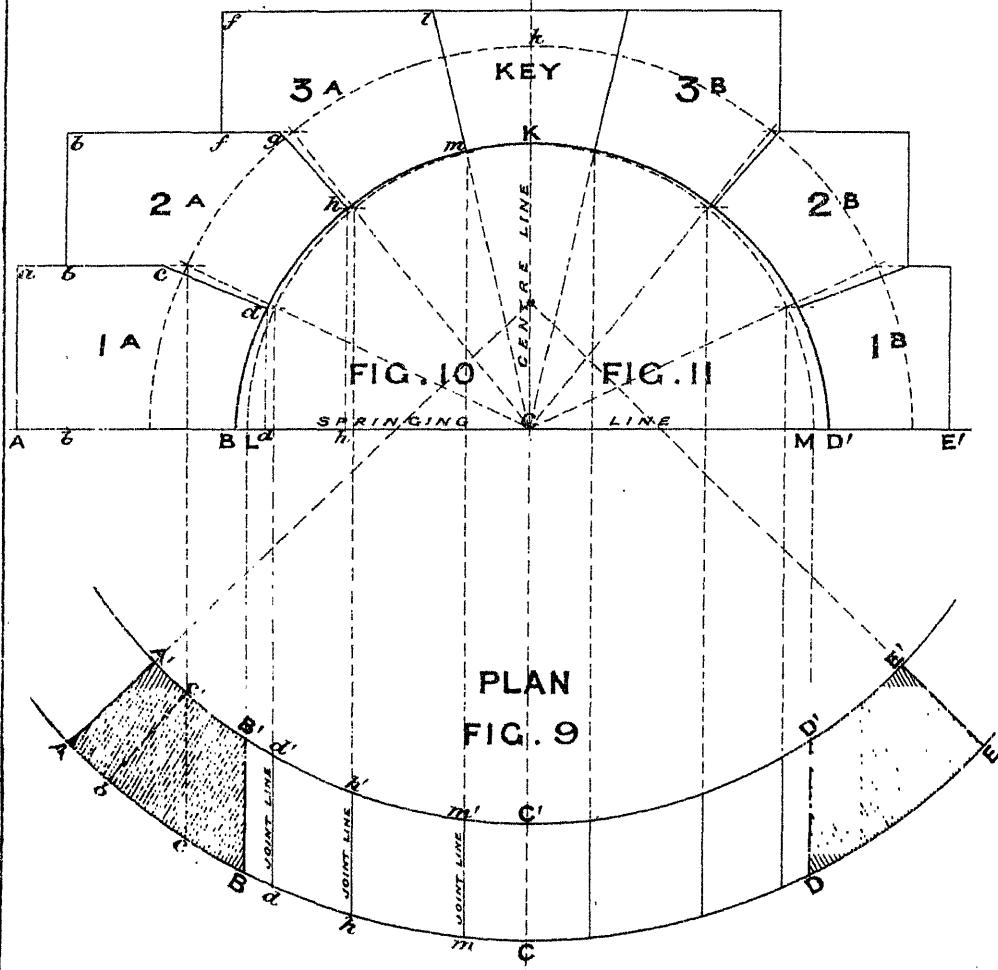
FIG. 14

ARCS CIRCULAR ON PLAN

DEVELOPMENTS

— HALF CONVEX —
 (OUTSIDE)

— HALF CONCAVE —
 (INSIDE)



slight as to be scarcely perceptible, and need not in the present and the following example be taken notice of.

To construct a SEMI-CIRCULAR ARCH in a CYLINDRICAL WALL, whose line of soffit on the plan is parallel to the axis, the axes of the two cylinders intersecting each other at right angles.

Fig. 9.—Shews the plan of the arch, *B C D* being the opening.

Figs. 10 and 11 are the developed elevations.

In order to prevent confusion with Figs. 9, 10, and 11, and to make matters easier of explanation, three diagrams are here shewn containing Fig. 15, Figs. 16, 17, and Figs. 18, 19, these being slightly exaggerated to shew more clearly the working.

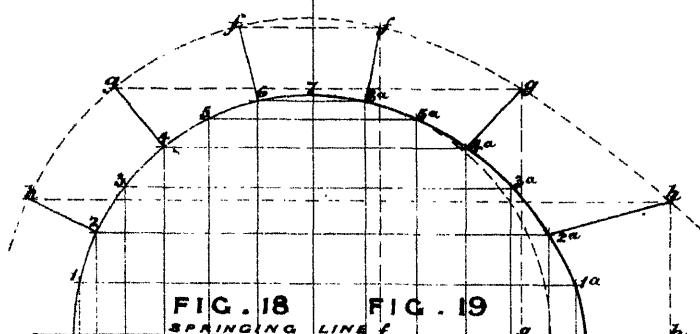
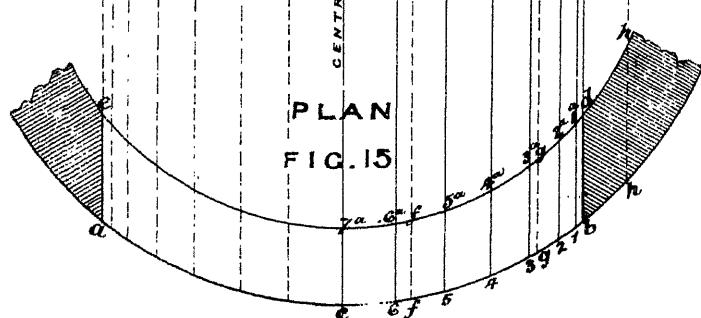
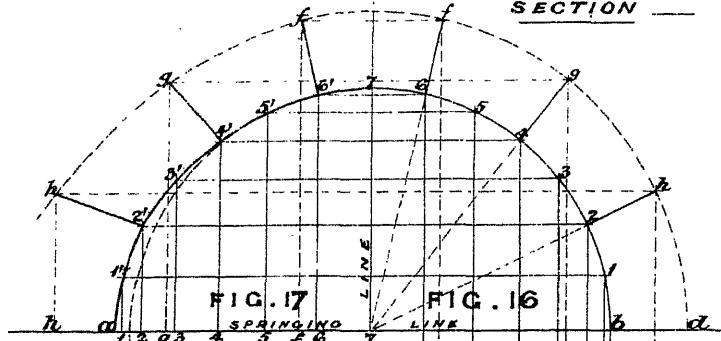
Let Fig. 15 be the plan of segment of cylinder, with the semi-cylinder penetrating the same at right angles to the axis at *a e*, *b d*.

Let Fig. 16 be the square section of the quadrant of cylinder, and divide this into any unequal number of equal parts corresponding to the number of arch stones required in Figs. 10 and 11, which in this example is seven, as 1, 2, 3, 4, 5, 6, 7, and project on to the segment line *a c b* on plan (Fig. 15), as *C 6, 5, 4, 3, 2, 1*; transfer this to the springing line *a b*, 1, 2, 3, 4, 5, 6, 7 (Fig. 17), which is now the developed line; erect ordinates, and make them equal in height to the ordinates of the square section, as 1', 2', 3', 4', &c.; draw line through the intersecting points 1', 2', 3', 4', &c., giving the curve required on the development at the point of penetration for the outside or convex face of cylinder.

For the development of the inside or concave face, let Fig. 18 be the square section, divided into seven equal parts, projecting the ordinates as before. Transfer from Fig. 15 1^a, 2^a, 3^a, 4^a, 5^a, 6^a, 7^a to the springing line (Fig. 19), erect ordinates and make them equal in height to those of square section at 1, 2, 3, 4, &c., and through the intersecting points 1^a, 2^a, 3^a, 4^a, &c., draw the line giving curve required at the point of penetration for the inside or concave face of cylinder.

For the joints, draw radiating lines at 2, 4, 6 (Figs. 16 and 18), and to make them of equal length draw a quadrant line with radius of the square section as *f g h*, project *f g h* on to plan (Fig. 15) as *f g h*, and transfer to the springing line (Figs. 17 and 19); erect ordinates at *f g h*, making equal in height to those of the square section. Next draw the joint lines *h 2'*,

ARCHES CIRCULAR ON PLAN

DEVELOPMENTHALF CONVEXSQUARESECTIONSQUARE
SECTIONDEVELOPMENT
HALF CONCAVE

$g\ 4'$, $f\ c'$ on Fig. 17, and $h\ 2^a$, $g\ 4^a$, and $f\ c^a$ (Fig. 19); the developed length of joint is thus obtained.

To set up the Elevation on the Developments for the Face Moulds.

Figs. 10 and 11.—Let $A\ E'$ be the springing line, $C\ K$ the centre line, and $L\ K\ M$ dotted line the square section of the cylinder whose centre is C . For the development $B\ K\ D$ proceed as previously described, and divide into any number of equal parts for the arch stones required—which in this example is seven—and draw the joints; the square bonding $a\ b$, $b\ f$, $f\ l$ may be set out at will, but should be set out from the inside or concave face, so as to obtain a parallel arch joint.

The joint $c\ b'$, No. 2 C (Fig. 13), which is the arch joint cutting out to the vertical joint b' , illustrates this.

The moulds for working each arch block are a bed mould and two face moulds. These are already set out on plan (Fig. 9) and elevations (Figs. 10 and 11), except the addition of a square line to the extreme size.

To work the springer:

For the bed mould take $A\ c$, $B\ d$ from the plan (Fig. 9) and transfer to 1 C (Fig. 12); the dotted line $B\ B'$ is line of the soffit on the bottom bed, the line $c\ c'$ is the line of joint on top bed, the line $d\ d'$ is the line of arris of the arch joint in soffit, and the line $A\ A'$ is the radiating vertical joint. No. 1 A (Fig. 12) is the face mould for convex face, and No. 1 B , Fig. 12, is the face mould for concave face; both of these are transferred from 1 A and 1 B (Figs. 10 and 11), with the addition of the square line $e\ e'$.

Work the two beds (bottom and top) parallel to each other, and of the height of the face mould. Scribe the bed mould No. 1 C (Fig. 12), on both beds, and work the two faces convex and concave through, and also the vertical joint $A\ a$, which must be at right angles to beds; this will form a portion of a hollow cylinder similar to sketch Fig. 7. Now scribe in the face moulds 1 A and 1 B (Fig. 12), on the convex and concave faces respectively, and work the arch joint $c\ d$ through and for the soffit, cut in arrises to the lines, and work drafts parallel to the bed $B\ B'$ until the whole of the soffit is finished.

In this arch the soffit is not a winding surface.

To work the Second Arch Stone No. 2 A (Fig. 10).

Let No. 2 C (Fig. 13) be the bed mould, project the extreme points $b h$, No. 2 A (Fig. 10), on to springing line $A C$. This being a developed face it will require folding back on to the segment line $A C E$ of plan (Fig. 9), as $b d h$, and transfer this to No. 2 C, which gives the bed mould.

No. 2 A (Fig. 13) is the face mould for convex face, and No. 2 B (Fig. 13) is the face mould for concave face, and both of these are transferred from 2 A and 2 B (Figs. 10 and 11), with the addition of the square line l .

Work the two beds (bottom and top) parallel to each other, and to the height of the face mould. The bottom bed is worked as a surface of operation for the application of the bed mould, and it is all cut away except the arris $d d'$. Scribe the bed mould 2 C (Fig. 13) in on each bed, and work the two faces convex and concave through, and scribe in the face moulds 2 A and 2 B (Fig. 13).

Work the vertical joint $b b$ square with either the top or bottom beds, and work the bed $b c$ and joint $c d$; then joint $g h$, and, lastly, soffit $d h$.

Fig. 14.—Nos. 3 A, 3 B, and 3 C are the face moulds and bed mould of the third arch stone, and together with the keystone are projected and worked in precisely the same manner as the foregoing Nos. 1 and 2 stones.

It will be advisable for the student to work small models, which should be constructed to scale in plaster, clay, or other soft material. The moulds for these models may be cut out of stout drawing paper, and in their application will be found the best method of obtaining knowledge of these subjects.

PLATES XXIV., XXV., XXVI.—SKEW ARCH AND NICHES.

To construct a SEMI-CIRCULAR ARCH RIB, the oblique angle of which does not extend more than ten or twelve degrees from a right angle, the joints being parallel to axis, and in the same planes.

This is not a difficult problem, as the arch within these limits may be set out and worked as a right arch ; but beyond these a different principle of construction is necessary.

The archivolt and arch ribs to coffered vaulting at the entrance to Burlington House, Piccadilly (about 20 feet span), and the archivolt at entrance to the Criterion Restaurant, Piccadilly, which are similar to the above, were set out by the writer, and worked as herein described.

Fig. 1.—Shews the elevation of the arch, which is a semi-circle.

Fig. 2.—Shews the plan of the arch, *B G* and *D J* being the opening, *B D* and *G J* the inclination or angle of skew, *E* and *F* the centres, *A* and *H* the outer face line of the arch, and *C K* the inner face line of the arch.

There is no difference in the outer and inner faces of the arch, both being alike, but the terms are here used for purpose of explanation.

Project *A C*, *B D* and *G J*, *H K* from the plan to the springing line (Fig. 1), as *a c*, *b d* and *g j*, *h k*, with *e* as centre, and *e a* and *e b* as radius, describe the semi-circles *a o h* and *b m g*, for the outside face, and with *f* as centre, and the same radius, describe the semi-circles *c p k* and *d n j*, for the inside face. For the joints, divide the arch into any convenient number of equal parts—in this example seven—as *q r s t u v* on line *b m g* of intrados, and with the same divisions repeat on the line *d n j* as *q' r' s' t' u' v'*; from the centre *e* draw radiating lines through these points, and produce to the outside curve or extrados for the outside, and for the inside of the arch; repeat the same from the centre *f*. It will be observed that the direction of joints is perfectly horizontal, the

SKEW ARCH

ELEVATION

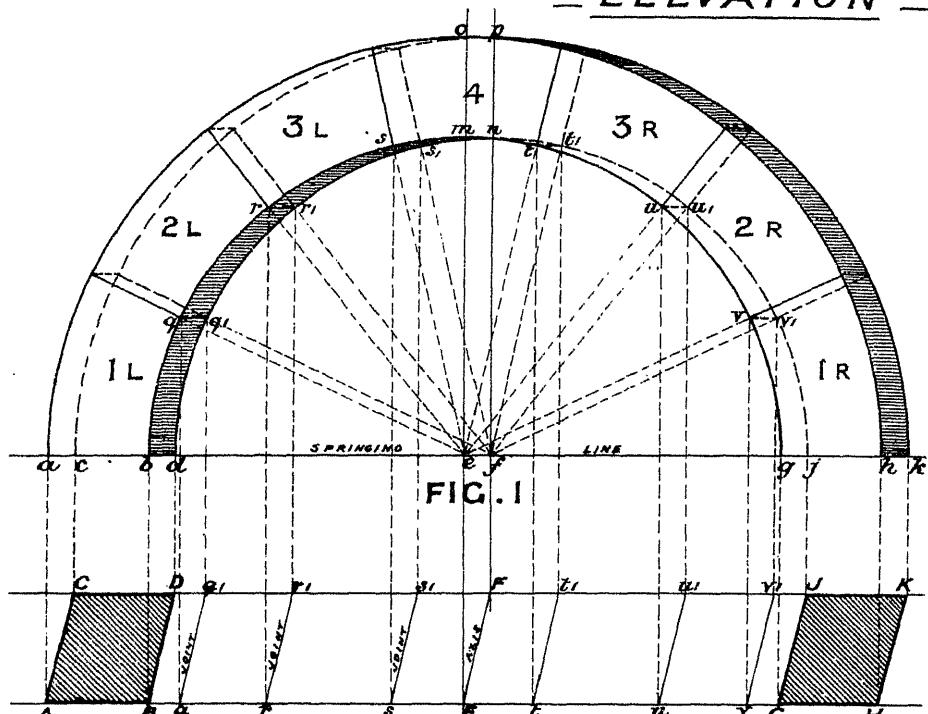


FIG. 2
PLAN

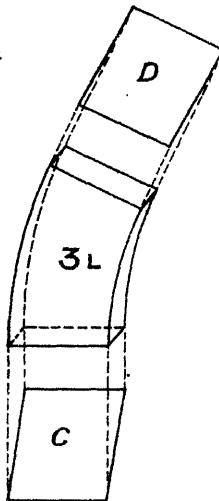
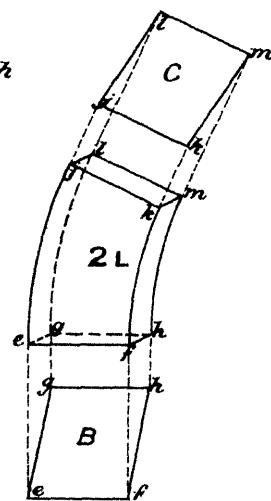
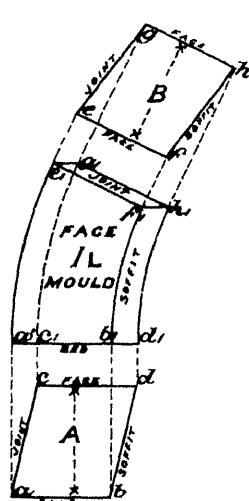


FIG. 3

FIG. 4

FIG. 5

lines $q' q$, $r' r$, $s' s$, &c., being level; the radiating lines and joints are also parallel to each other, and are therefore in the same plane.

This is all the setting out required, with the exception of the joint moulds.

To work the Arch Stones.

Fig. 3.—Let No. 1 L be the face mould of the springer and A and B the joint moulds.

The face mould 1 L , is transferred from the elevation Fig. 1, and the bottom bed or joint mould A , from plan (Fig. 2); for the joint mould B , draw a line parallel to joint $e' f'$, and project $e' f'$ and $g' h'$ as $e f$ and $g h$, of an equal and parallel thickness, as XX at A and B .

Work $a' b' e' f'$ outside face of springer No. 1 L , to a plane surface, and $c d g h$ inside, face parallel to it; scribe the face mould in to extreme size on each face as $a' d' e' g' h'$; scribe in the segment line $f' b'$ giving arris of soffit on outside face (this may be done by drawing the mould back, as $h' d'$ is the same segment and also the same length as $f' b'$).

Work the bottom bed A which is horizontal, and square with the vertical face, and scribe in the bed mould as $a b c d$, which will coincide with the lines on the face mould: now work the top joint B , this from the outside face will be full of the square, or, in other words, it makes an obtuse angle with the vertical face. This, however, is given by the face mould, as $e' f'$ is line of joint on the outside, and $g' h'$ on the inside.

Scribe in the joint mould B as $e f g h$, and work the soffit $b' d' f' h'$ through, as in a right arch, and finish with the back joint $a' c' e' g'$.

Fig. 4.—No. 2 L is worked similar to No. 1 L ; the top joint mould B of No. 1 is the bottom joint mould of No. 2, and the top joint mould C of No. 2 is the bottom joint mould of No. 3, and so on,—this is self evident. The bevels of these joints are found by projecting the points of the face mould, as $j k l m$, &c., as before described.

Begin by working the two vertical faces $e f j k$ and $g h l m$ parallel to each other, scribe in the face mould No. 2 to the extreme size as $c f h j l m$, and work both joints B and C ; the top joint C is full of the square, whilst the bottom joint B is slack of the square from the outside face, the amount of the obtuse and acute angle being given on the face mould.

Fig. 5.—No. 3 L and the key-stone are worked precisely similar to the foregoing.

One set of moulds for one half of the arch only is required, as the four face moulds and the four joint moulds will work the complete arch:

being a plain arch without mouldings, the stones are reversible; this is apparent on looking at the elevation, but should there be an architrave moulding on one face, a mould to each stone is then required.

To construct a SPHERICAL NICHE in a straight wall with horizontal splay beds, and with vertical joints.

Figs. 6 and 7.—Shew the elevation and plan of the niche.

Let $A E$ be the face line of the niche on plan (Fig. 7), $B D$ the opening and C the centre; with $C B$ or $C D$ as radius, and C as centre, describe a semi-circle $B K D$, which is plan of extreme size of inside of niche; project $A B C D E$ to the springing line on elevation (Fig. 6), as $a b c d e$, and at c erect perpendicular for the centre line. With c as centre and $c b$ or $c d$ as radius, describe the semi-circle $b k d$ for the outer curve, and divide this into five equal parts as at $f g h i$; from c draw radiating lines through these points of division, cutting the horizontal bed at $l m n o$, giving the joints, the bevel of which will be continued horizontally round the niche as at $f i$ and $g h$. For joints to the plan draw ordinates at $f g h i$ and $l m$, &c., and project them on to line $A E$ on plan (Fig. 7), as $F G H I$ and $L M$, &c.; at $L F M G$ describe the semi-circles, giving the horizontal line of splay joints. For dividing joints on the plan, take the second course first and divide the line of semi-circle $F Q I$ into four equal parts as $P Q R$, and from C draw radiating lines through these divisions, producing them on to the line $L N O$, which gives the joints. The springers $1 L$ and $1 R$ in the first course will require to be about half the depth of others in the same course, in order to break the bond (as will be seen by reference to the plan); therefore, on the line $B K D$, set off say little more than half for the two springers as $B S$ and $D V$, dividing the remainder into three equal parts as at $S T U V$, and draw the lines through, radiating from the centre to the back, giving the joints in the bottom course.

The top course No. 3 is in one stone, and to prevent any tendency to slip out of its place forward, the upper part of bed may be kept square; this would require notching on the inside, as $M M 2$ and $N M 2$ on the plan, and $m 4 4$ and $n 5 5$ on the elevation.

NICHE — ELEVATION —

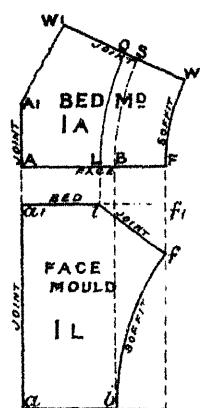
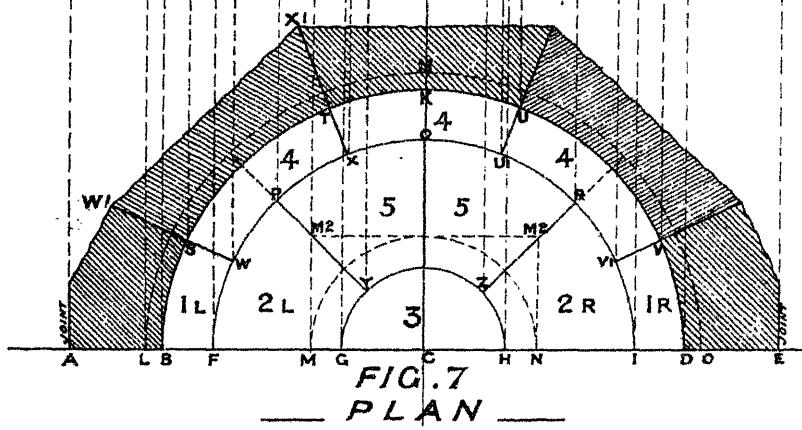
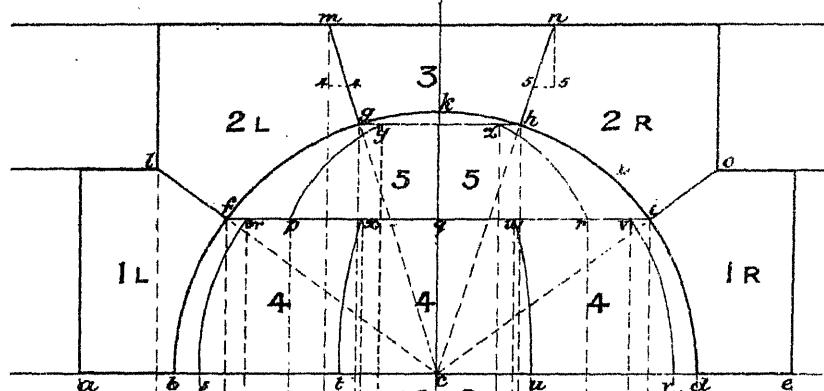


FIG. 8

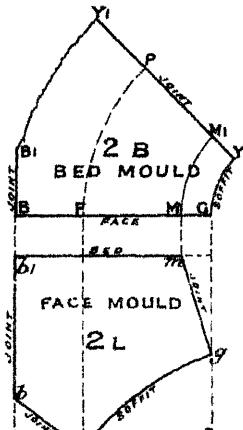


FIG. 9

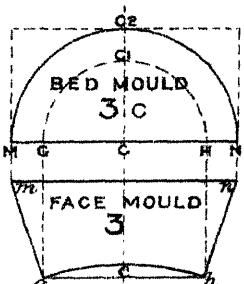


FIG. 10

The vertical joints are shewn on the elevation by projecting up from the plan, as shewn by the dotted lines $w p x q$, &c.

To work the Springer.

Fig. 8.—1 A is the bed mould transferred from the plan (Fig. 7), the line $A F$ being the vertical face on the front, $F W$ the horizontal line of arris of soffit and splay joint on the top bed, $L O$ the outside line of splay joint on top bed, the dotted line $B S$ the line of soffit on bottom bed, $W W'$ the line of vertical radiating joint, and $A A'$ the line of vertical face joint.

1 L is the face mould transferred from the elevation (Fig. 6), which will also apply as joint mould at $W W'$.

The form of the stone required to work this will be a wedge-shape prism, containing the bed mould to the extreme size on the top bed as $A F W W'$; the bottom bed is a little smaller, and is contained within the lines $A B S W'$, and of the extreme height of the face mould from a to a' .

Begin by working the front vertical face $A B F$, and scribe the face mould 1 L on, as $a b f l a'$. Work the vertical joint $A A'$ as $a a'$ square with the front face, and bottom and top beds square with the front face, scribing on the bed mould 1 A , and also the inside vertical joint $W W'$, scribing in the face mould as $a b f l a'$. It is necessary to work the whole of the top bed, although a portion from l to $f 1$ will be cut away for the splay joint, in order to get horizontal line $F W$ at f ; to obtain this arris, square down the concave line from F to W to the depth at f , or a draft from F to W , may be worked by the aid of a templet. This being done, trammel the line f parallel to $f 1$, giving the arris line required; the line $L O$ is marked on the top bed with the templet, and the splay joint from f to l then worked off. The soffit now remains to be worked: cut in the drafts $B S$ on the bottom bed and $F W$ on the top bed, and drafts $b f$ on the face and joint; a convex templet is used as at g for the intermediate drafts, which are cut in as close as convenient, until the whole surface is worked.

The templet g must not be applied parallel to the joints, but to lines radiating from the centre.

The three No. 4 stones will be worked similarly to the foregoing; one vertical joint is worked first as a surface of operation, instead of the front face as in the springer.

NICHE — ELEVATION —

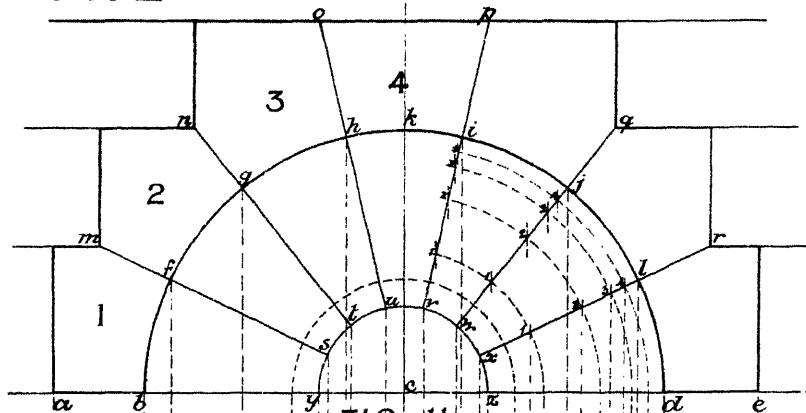


FIG. 11

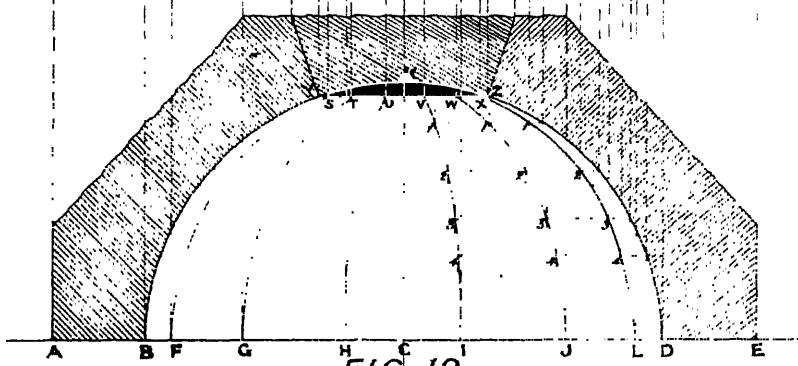


FIG. 12
PLAN

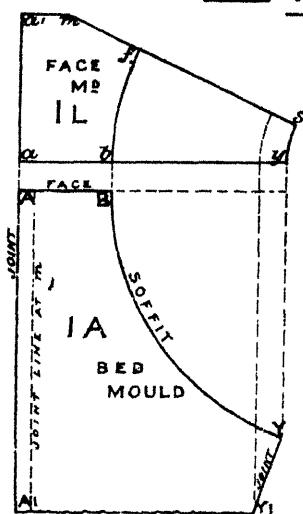


FIG. 13

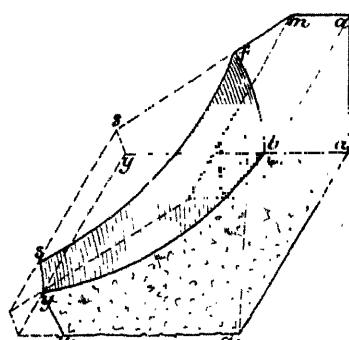


FIG. 14

To work No. 2 L Stone.

Fig. 9.—2 *B* is the bed mould transferred from the plan (Fig. 7), the line *B G* being the vertical face on the front, and *G Y* the horizontal line of the arris of soffit and the splay joint on the top bed, *M M'* the outside line of the splay joint top bed, the dotted line *F' P* the line of soffit on bottom bed, *Y Y'* the line of vertical radiating joint, and *B B'* the line of vertical face joint.

2 *L* is the face mould, transferred from the elevation (Fig. 6), which will also apply as joint mould at *Y Y'*.

The form of stone required to work this will be a wedge-shape prism, containing the bed mould, to the extreme size as *B G Y Y' 1*, and of the extreme height of the face mould, from *f 1* to *b 1*.

Begin by working the front vertical face, and scribe the face mould 2 *L* on as *b 1 b' f g m*. Work the vertical joint *b b'* square with the front face, also the top bed, and scribe the bed mould on. Work the bottom bed as a surface of operation; the only part required being the arris of the splay joint, and soffit *F' P*, the rest of the bed being cut away.

This is the easiest and most accurate way of working, but the bed need not necessarily be worked as a whole, a portion only being required, sufficient to obtain the arris line *F' P*; in this case the soffit *F' G* should be worked after the arris line is drawn on the bed, by a convex templet made from *f* to *g*, and the splay joint is worked from a bevelled templet made from *g f b*.

The remaining portion of the stone is worked as before described to springer.

The two No. 5 stones are worked similarly.

To work the Key-stone No. 3.

Fig. 10.—3 *C* is the bed mould transferred from the plan (Fig. 7), the line *M N* being the vertical face on the front, *M C 2 N* the top line of the splay joint, and *G C 1 H* the line of arris of soffit, and the splay joint on bottom.

No. 3 is the face mould transferred from the elevation (Fig. 6).

Begin by working the vertical face *M N*, scribing in the face mould as *g h m n*. Work the top bed through square with the face, scribing in the bed mould, also the bottom bed parallel to the top at extreme points *g* and *h*, and with a templet scribe *G C H* the arris of the soffit and the splay joint. Work the joint round to the splay lines, then the soffit by cutting in the draft *g c h* on the front, and with a convex templet made from *C* to *C 1*, complete the surface.

The niche need not be jointed as here shewn, for much depends on its size, and the size of the stone convenient to use, but the general principle of working will be the same.

To construct a SPHERICAL NICHE in a straight wall, with joints radiating from the centre.

Figs. 11 and 12.—Shew elevation and plan of the niche.

Let $A E$ be the vertical face line of the niche on the plan (Fig. 12), $B D$ the opening, and C the centre. With $C B$ or $C D$ as a radius, and C as a centre, describe the semi-circle $B K D$, which is the plan of extreme size of the inside of niche, and project $A B C D E$ to the springing line $a e$ on the elevation (Fig. 11), as $a b c d e$. At c erect a perpendicular for the centre line, and, with c as centre and $c b$ or $c d$ as radius, describe the semi-circle $b k d$ for the outer curve. With $c y$ as a radius and c as the centre, describe a semi-circle for the centre stone, which may be of any convenient size. Divide the semi-circle $b k d$ into seven equal parts as $f g h i j l$, and through these points of division from c draw radiating lines cutting horizontal beds at $m n o p$, &c., and the centre stone at $s t u v$, &c., which gives the joints. Draw ordinates from $f g h i$, &c., and project on to the line $A B$ as $F G H I$, &c., and repeat the same at $s t u v$, &c., on the line $Y Z$, giving joint lines on the plan: to determine points in the curve of the soffit for templets, the dotted lines at the right hand of the niche shews how they are obtained. The dotted segment line from 1 to 1, 2 to 2, 3 to 3, &c., on elevation will be the section of curve at corresponding points on the plan at 1 1, 2 2, 3 3, &c., and also gives the points in the line of curve for the joints on plan, although the last named is not necessary for the setting out or the working.

To work the Springer 1 L.

Fig. 13.—1 A is the bed or joint mould transferred from the plan (Fig. 12), the line $A B$ being the front vertical face, $B Y$ the line of soffit, $Y Y 1$ the splay joint, and $A A 1$ the vertical face joint.

No. 1 L is the face mould transferred from the elevation (Fig. 11).

The form of stone required will be that of a wedge-shape prism (as in sketch, Fig. 14), containing the face mould to the extreme size as $a' a y s m$.

Begin by working the bed or joint $a b y$, keeping the segmental line

B Y fair for arris, and scribe the bed mould *1 A* on. Work the vertical face and scribe in the face mould *1 L*, and the other bed *mfs*, scribing in the bed mould *1 A*. Work the vertical joint *a a'*, and top bed *a' m*, and lastly, the soffit, the working of this being guided by one or two templets made from *1 1, 2 2, &c.*

The remaining stones are worked similar to the foregoing, keeping in mind the principle that the stone is contained within the wedge-shape prism, thus making it easy of comprehension.

PLATES XXVII., XXVIII., XXIX.— CYLINDRICAL VAULTING.

To obtain the PROFILES or CURVATURE of a GROIN.

Fig. 1.—Let $A B C D$ be a rectangular plan, its vault to be intersected by two semi-cylinders.

Bisect the line $H J$, and with F as a centre, describe the semi-circle $G H J$ (the given section), which divide into any number of equal parts in this example 12, and project ordinates $1 2 3 4 5$, &c., through the springing line $H F J$ on to the diagonal line $A E D$ as $1' 2' 3' 4' 5'$, &c. Erect ordinates perpendicular to the diagonal, and make them equal in height to those of semi-circle $G H J$, and through the points of intersection draw the semi-ellipse, which is the curve of the groin.

The outer profile $K L M$ is obtained in the same manner, namely, by projecting ordinates from the diagonal, and making them of equal height to those of semi-circle, and tracing semi-elliptic curve through the points of intersection.

These profiles may also be obtained by means of an elliptic trammel, taking $A D$ and $K L$ respectively as the major axes, and $E N$ and $M O$ as the minor axes, and drawing semi-ellipses by a continuous curve.

To obtain the PROFILES for the ANNULAR GROIN.

Fig. 2.—Let $A B C D$ be the given plan.

Produce $A C$ and $B D$ until they meet in the point X , which is the centre of the radiating vault; bisect the line $A C$ and $B D$ at E and G , and describe the two semi-circles $A J C$ and $B D H$ the given section; divide the diameter of either semi-circle as $A C$ into any number of equal parts—in this example 10—the last division from 1 to A and 9 to C may be

FIG. 1

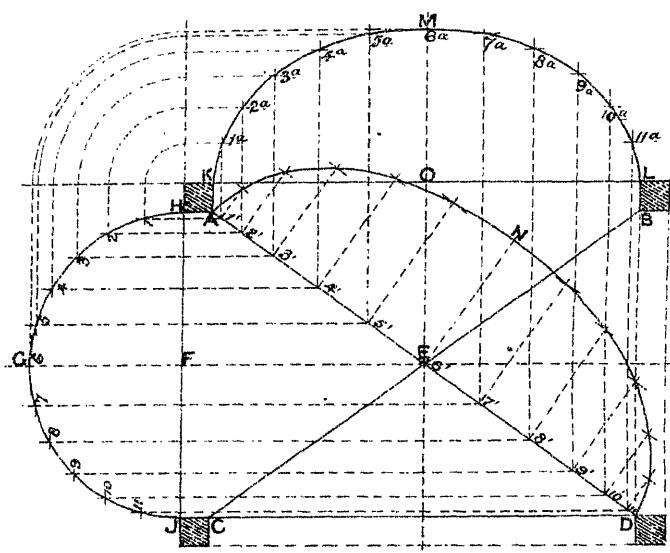
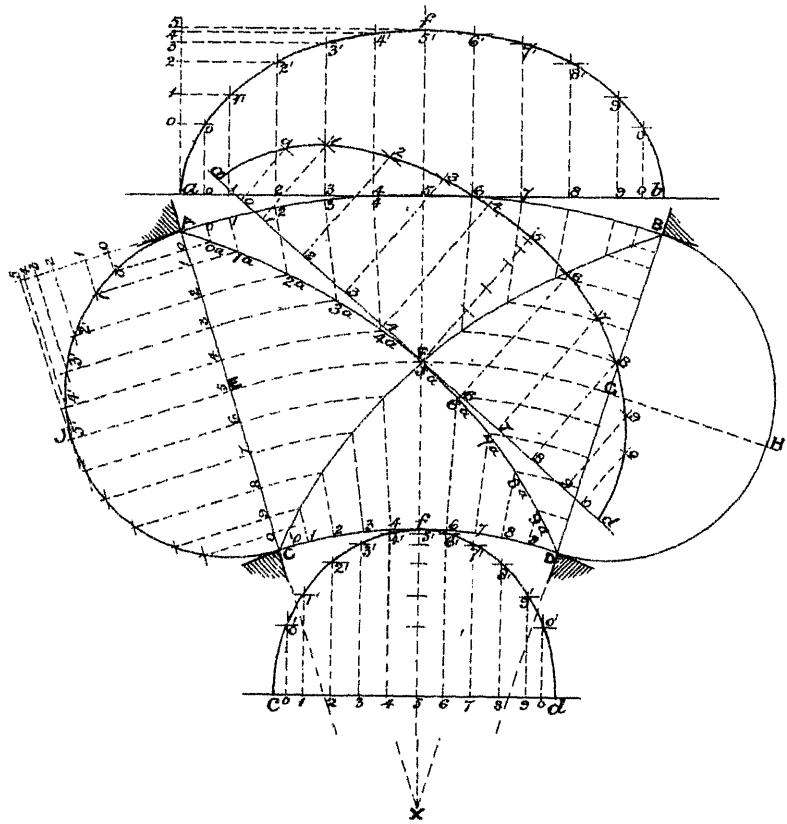


FIG. 2



again divided as at O , and erect ordinates as $O 1 2 3 4 5$, &c., cutting the semi-circle at $O' 1' 2' 3' 4' 5'$, &c.; at the centre X , with radius $O 1 2 3 4 5$, &c. on the diameter $A C$, describe concentric arcs to the diameter $B D$. Divide the segmental line $A 5 B$ into the same number of equal parts as the diameter $A C$, as $O 1 2 3 4 5$, &c., and from these points draw radiating lines from centre X , intersecting the above arcs at $O'' 1'' 2'' 3'' 4'' 5''$, &c., and through the points of intersection draw the curve, giving the plan of groins $A F D$ and $C F B$.

To describe the outer and inner profiles, develop segmental line $A 5 B$ as right line $a b$, and $C f D$ as right line $c d$, and transfer the divisions $O 1 2 3 4 5$, &c.; erect ordinates as $O' 1' 2' 3' 4' 5'$, &c., equal in height to those of the semi-circle $A J C$, and through the points $O' 1' 2' 3' 4' 5'$, &c., draw the curve which gives the true sections.

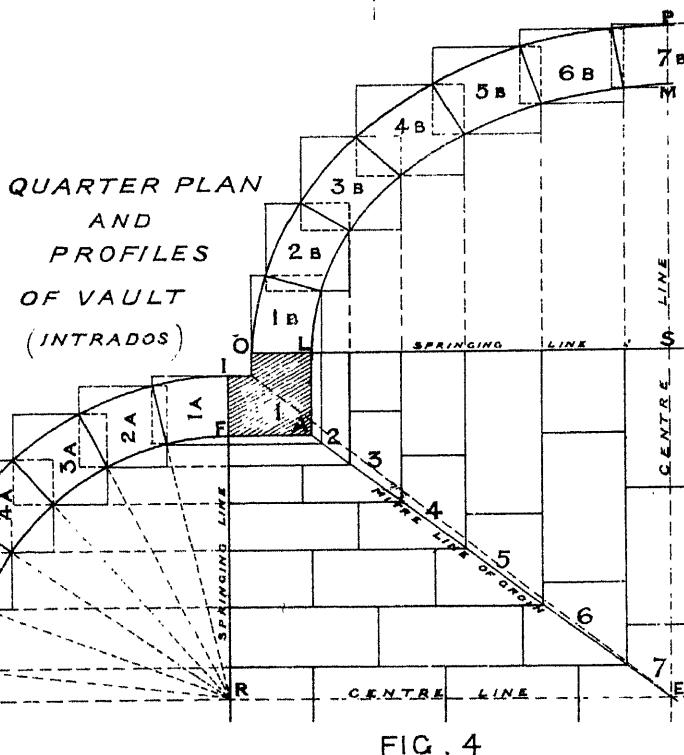
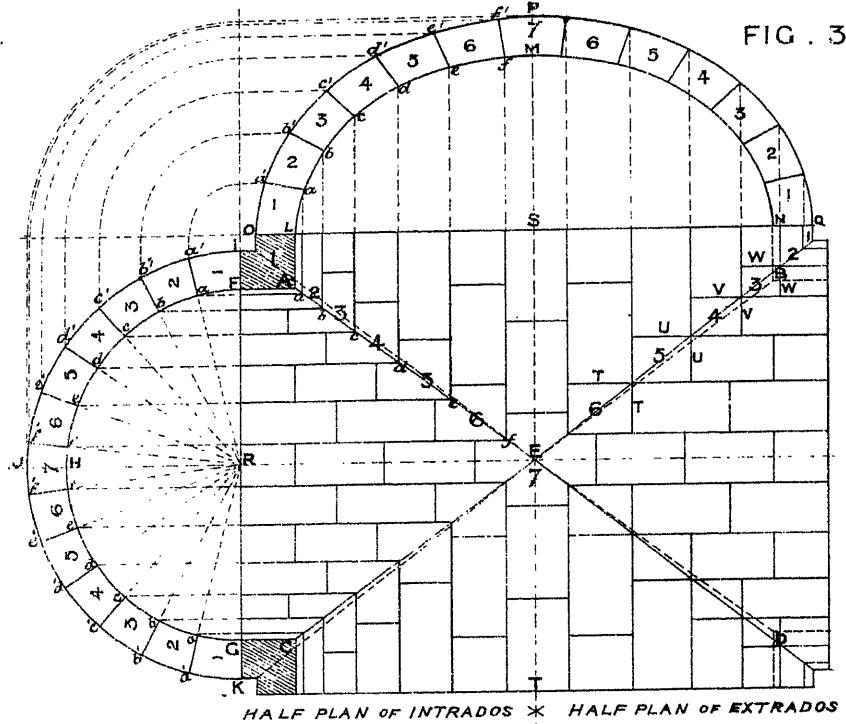
To find the profile on the diagonals $A F' D$ and $C F' B$, develop line $A F D$ as right line $a F' d$, and transfer divisions $O'' 1'' 2'' 3'' 4'' 5''$, &c. on the same, erect ordinates, and make them equal in height to those of the semi-circle $A J C$; through the points of intersection draw the curve, giving the true section at the mitre of groins, when bent or worked, so as to stand on the curve $A F D$ on the plan.

To construct a RECTANGULAR VAULT, intersected by two semi-cylinders, crossing each other at right angles, and of equal height, each course of Stone being level and parallel to the axes of the Cylinders.

Fig. 3.—Let $A B C D$ be the springing of the groins, $A E D$ and $C E B$ plan of the groins or intersection of cylindric surfaces, $F H G$ is a section of the soffit or intrados whose profile is a semi-circle, and $I K J$ a section of the outside or extrados, both of which are concentric semi-circles. The form of this section determines the shape of the groin and outer profile. $L M N$ and $O P Q$ are sections respectively of the intrados and extrados of the semi-elliptic profile, the curves of which are found by the method described in Fig. 1.

To obtain the joints, divide the semi-circle $I J K$ into any unequal number of equal parts (convenient to the size of the stones), in this example 18, and draw the arch joints radiating from the centre R as $a' b' c' d' e' f'$, &c. From the joints on the soffit, as $a b c d e f$, &c., project lines on to the plan, cutting the diagonal line $A E - C E$ at $a b c d e f$, &c.; and, from these points of intersection, project lines on to the semi-ellipse $L M N$ for intrados, and project points from the extrados $I J$, to the

VAULTING - CYLINDRICAL



VAULTING — CYLINDRICAL

FIG. 10

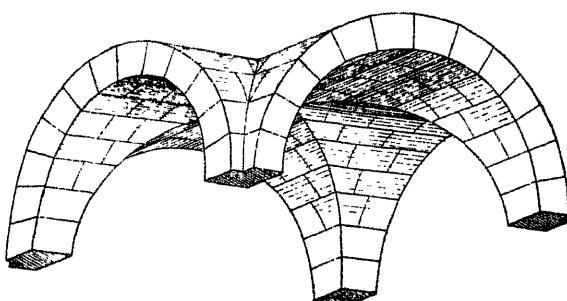
SKETCH OF VAULT

FIG. 5.

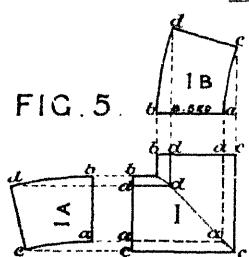


FIG. 6.

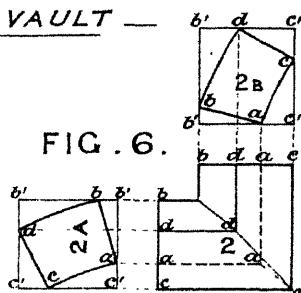


FIG. 5A

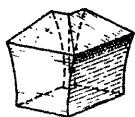


FIG. 6A

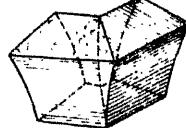


FIG. 6B

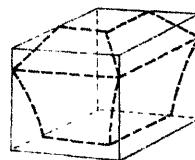


FIG. 7A

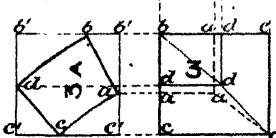
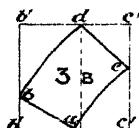
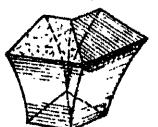


FIG. 7

FIG. 9

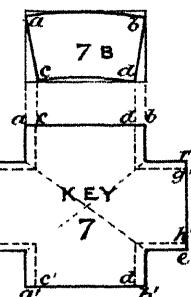
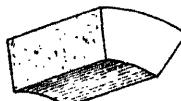


FIG. 8

extrados $O P$, and draw the joint lines through, which gives the direction and position of joints.

The vertical cross joints in vault may be drawn at pleasure, care being taken to "bond" by breaking joint, but the angle quoins of the groin must be treated differently, and for this reason: the extrados of the arch is set out on the plan as shewn on the right hand half, and; by noting the joints 3 4 5 6 at $T U V W$, it will be observed that the vertical joints of the groins are set out to the mitre, which governs the size on the soffit. If the stones were set out less than this there would not be so good a bed, as this size should be the minimum.

The dotted diagonal lines on the half plan of the intrados shew the mitre on the extrados, and the dotted diagonal lines on the half plan of the extrados shew the mitre of the groin on the intrados. Although the extrados is here shewn apparently as a finished face, yet in practice it is not so, as it is generally left rough, and stepped out as a seating for concrete.

The stones which present any difficulty in the working in this form of vault are the angular groins, and these are the weakest part of the vault, on account of each stone acting to some extent as a corbel, and one corbel standing upon another, as indicated by the sketch (Fig. 10). Therefore care must be taken in working them true to shape and form.

The stones in other portion of the vault may be worked as those in a right arch.

The easiest way of working either of the groin stones is to take a block cubical in form, and containing it, as shewn in Fig. 6 B ; and, although in stones No. 3, 4 and 5, there is a little waste attached to this method, yet it gives the best results, and is more correct in shape when worked than by using bevels. The danger of using bevels is in the application of them, that is to say, should there be the least deviation from the actual position in applying the bevel, the stone would not be true. This would not be of so much consequence were it an isolated block, but where it is surrounded by others, and forming a cylindric surface, it is of importance.

Fig. 4.—Shews a quarter plan and profiles of the vault to a larger scale, for the purpose of shewing more clearly the working of the groins;

in actual work this is all that is necessary to set out, as the set of moulds of one groin will work the three others if "handed," that is worked in pairs.

Fig. 5.—Is the springing stone. No. 1 is the bed mould, 1 A and 1 B the joint moulds.

Begin by working the bottom bed, this being horizontal, and scribe on the bed mould; next work the two vertical faces or joints $c a d b$, and scribe in the joint moulds 1 A and 1 B, then the top splay joint $c d$, and lastly the curved soffit, care being taken to keep the mitre true.

Fig. 5A.—Shews a sketch of this stone finished; the working of this differs very little from that of an ordinary arch stone.

Fig. 6.—Is the second stone. No. 2 is the bed mould, and 2 A and 2 B the joint moulds.

Work the two beds parallel to each other, and of the extreme height of the joint mould from a to d , as surfaces of operation; labour need not be thrown away on these beds, as they may be roughly chiselled over and at the same time true: the mason should know just where to put the work that is necessary, in some cases, perhaps, a couple or three straight drafts being all that is required. This done, scribe in the bed mould No. 1 on the bottom and top bed. Work the vertical joints $c a d b$, scribing in the joint moulds 2 A and 2 B. The position of these moulds is given by the circumscribing rectangle, coinciding with the lines on the bed mould; next work the splay beds, and then the curved soffit guided by a convex templet, keeping the mitre also true.

Fig. 6A.—Shews a sketch of the stone when finished.

Fig. 6B.—Shews a sketch of the same contained within the circumscribing prism.

Fig. 7.—Is the third stone. This is worked precisely as the last named in Fig. 6.

Fig. 7A.—Shews a sketch of this stone when finished.

Fig. 8.—Is the key-stone No. 7.

In working this stone commence on the soffit plane, the points *a b* and *e f* and points opposite these being in this plane, which may be taken as a surface of operation. Scribe in the bed mould No. 7; the dotted lines *c d* and *g h* shew the finished arris on the soffit. Work the two joints *a b* and the two joints *e f* at right angles to the plane, and scribe in the joint moulds 7 A and 7 B, then the splay joints *a c—f g*, &c., and lastly the concave surfaces *c d* and *g h*. The mitres of intersection being here very obtuse must be carefully worked.

Fig. 9.—Shews a sketch of one of the ordinary arch stones between the groins, which is worked similar to that of a right arch.

Fig. 10.—Shews a sketch of the vault.

PLATES XXX., XXXI., XXXII., XXXIII.—DOMES AND PENDENTIVES.

The Dome may be generally described as a convex roof or vault, covering a circular, elliptical, or polygonal area.

The Pendentives are the corbellings resting on the internal angles of piers, and support the dome.

Fig. 1A.—If a hemisphere or other portion of a sphere, *a b a*, be intersected by vertical planes, *a d c*, equidistant from its centre, the angular or spandril portion, *e e*, between the boundaries of the planes are pendentives.

Fig. 1.—Shews half plan of square area, covered by dome and supported by pendentives.

Fig. 2.—Shews sectional elevation of the dome and pendentives, taken through the centre line *E F* on plan.

For the making of the moulds, and working of this vault, a quarter plan only is required to be set out full size; but in order to shew it more clearly the half is here given.

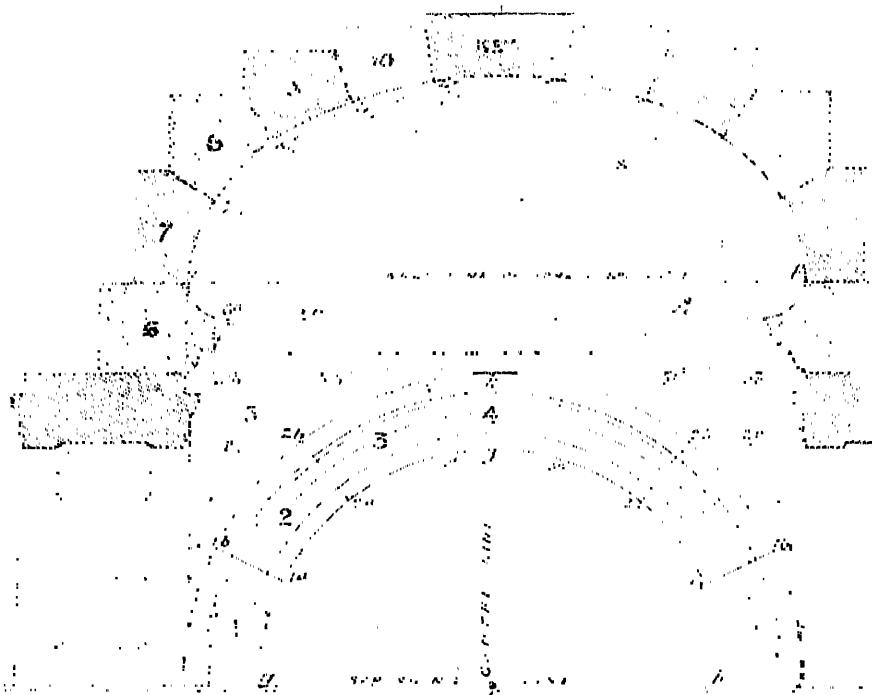
Begin by setting out on the plan (Fig. 1) the rectangle *A B E F*, the line *E F* being the centre line, and the line *C D* being the transverse centre line. The semi-circle *E D F* is the half of inscribed circle, forming wall line of cornice and dome.

Set out the archivolt on impost caps at *A* and *B* as shewn by hatched lines, which gives the span or opening of arches, and project on to springing line of section (Fig. 2).

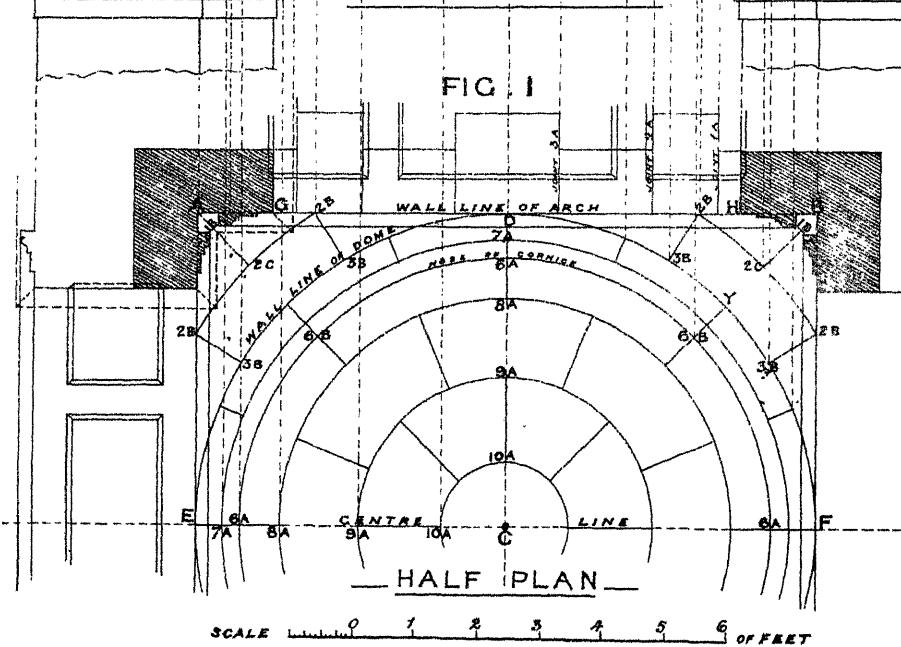
At *c* as centre, with *c g* or *c h* as radius, describe semi-circle *g j h* for soffit, and semi-circles concentric to this for lines of mouldings forming archivolt. The arch at crown *j k* must equal in height the width at spring-

DOME AND PENDENTIVES

FIG. 2



SECTIONAL ELEVATION



ing $A\ G$, Fig. 1, so that the corbelling of pendentives start exactly in the angles at A and B on springing line at top of impost cap.

Divide the arch into any number of equal parts—in this example 7—and draw joints radiating from centre C as $1^a\ 2^a\ 3^a\ \&c.$; at extremities of joints as $1\ b\ 2\ b$ draw horizontal lines for beds (these are better if worked in conical or splay beds, but as it takes more material they are generally horizontal as shewn at Fig. 3). Project $1\ b, 2\ b$ on to wall line of arch on plan, fig. 1, and with C as centre describe arcs $1\ B, 2\ B$, giving line of curvature of horizontal joints in pendentive. The vertical joints may be drawn in at will, but are here shewn as at $1\ B, 2\ B, 3\ B$.

It will be observed that the arch is panelled on soffit, and is shewn on section by a chamfer, the detail being too small to shew a moulding.

Set up the section of cornice No. 6 and project nosing on to plan (Fig. 1) as $6\ A$. For vertical joints divide cornice into 8 parts, this being a convenient number for stones in the dome, and also breaking joint with those in pendentives.

Draw in the joints which radiate from the centre C (Fig. 1) at $6\ A, 6\ B$, and project on to the section (Fig. 2).

The wall line of the cornice, $e\ f$, Fig. 2, is the springing line of dome, and equals the width $E\ C\ F$ on centre line of plan (Fig. 1).

On the line $e\ f$ set up the curvature of dome, which is a semi-ellipse, and may be struck with the trammel or the curve may be traced through points in the inter-section of lines.

For the joints divide the dome into any convenient number—in this example 9—as Nos. 7, 8, 9, 10, &c., and draw radiating lines perpendicular to the tangent of the curve, as at $7^a, 8^a, 9^a, \&c.$; see construction as shewn by dotted lines $X\ X$.

Project $7^a, 8^a, 9^a, \&c.$, on to plan (Fig. 1), and, with C as centre, and $7\ A, 8\ A, 9\ A, \&c.$, as radii, describe semi-circles which give horizontal lines in splay joints of dome.

For the vertical joints follow divisions of joints in cornice, the same number (eight) being required in each course, breaking joint, as shewn on plan and section.

Fig. 3.—Is a section on the centre line, shewing corbelling out of the pendentive taken across the diagonal from B to Y on the plan (Fig. 1), the radius of which equals the distance from C to B , and the projection B', Y' equalling B, Y on the plan (Fig. 1).

FIG. 1A

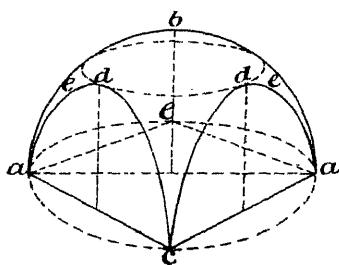


FIG. 3

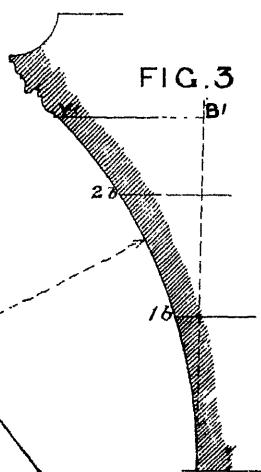


FIG. 4

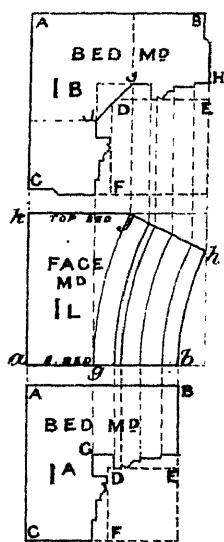


FIG. 5

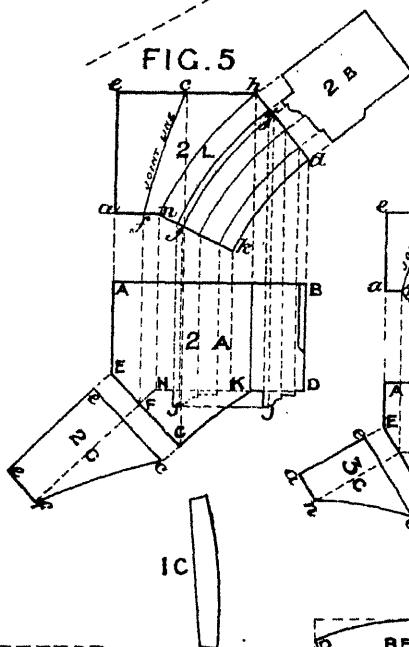


FIG. 6

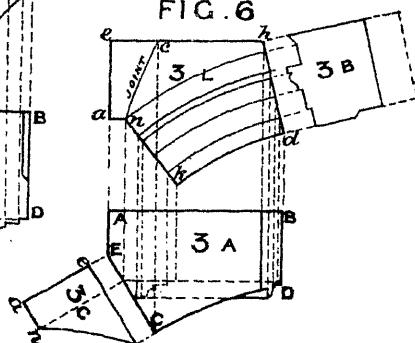


FIG. 7

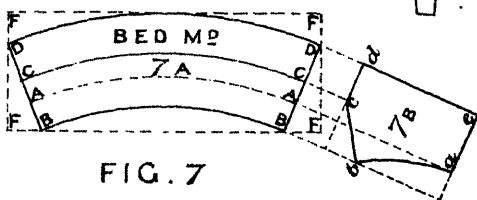


FIG. 9

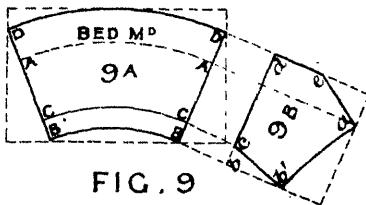


FIG. 8

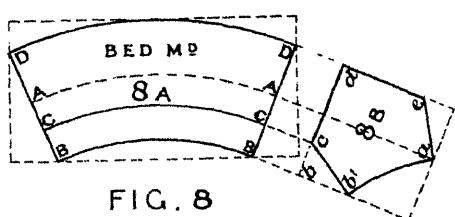
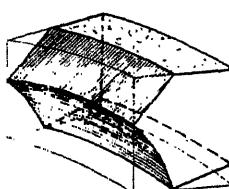


FIG. 10



SCALE OF 0 1 2 3 4 5 FT

To work the Double Springer No 1.

Fig. 4.—1 *A* is the bottom bed mould, 1 *B* is the top bed mould, and 1 *L* is the face mould.

The stone will require to be cubical in form, and the size of bed mould 1 *B*, and of the height of face mould 1 *L*.

Work the bottom bed and scribe in bed mould 1 *A*; work vertical joints *A B* and *A C* square with the bottom bed, and apply face mould 1 *L* to each joint and scribe in; next take the top bed *k j* parallel to bottom bed. Work out the check *D E F* right through, keeping the nosing of moulding fair or clean, and apply part of face mould 1 *L* coinciding with the moulds marked on vertical joints *A B* and *A C*, which gives the soffit line *h b*, the splay joint *j h* and the nose and mitre line of the archivolt.

Work the splay joints *j h* and scribe in the archivolt, which is part of the bed mould 1 *A*; next the soffits and panels and archivolt mouldings guided by convex templets; lastly, work the small concave portion of pendentive, which starts imperceptibly at the angle *G* on the bottom bed, and increases to *J J* on the top bed.

The convex templet 1 *C* gives the curvature in the centre from *G*—1 *A*, to *D*—1 *B*. An obtuse mitre is formed on each side where the spandrel intersects the archivolt, and is shewn by the segmental line *j g* on the face mould 1 *L*.

It will be observed that the archivolt on the bed mould 1 *B* is foreshortened, but 1 *A*, being a square section, is used on all arch joints.

To work No. 2 Arch Stone.

Fig. 5.—No. 2 *A* is the bed mould, 2 *L* the face mould, 2 *B* the joint mould of arch, and 2 *C* the joint mould of a portion of the pendentive.

This stone will require to be the size of the bed mould, and of the extreme height of the face mould 2 *L* from *k* to *h*.

Begin by working the top bed *e c h*—2 *L*, and scribe in bed mould 2 *A*, as *A B C D E*. Work the vertical joints *A B* and *E C* square with top bed, and scribe in the face mould 2 *L*, and joint mould 2 *C* respectively; point off vertical side *A E*, and rough out section of pendentive *c f* from joint *E C* on to face line *N K*, and work draft through at *J J* for nosing. Apply part of face mould *h d f n k*—2 *L*, coinciding with the face mould marked in on vertical joint *A B*, and work the splay joints *h d*—*n k*, and

bottom bed *a n.* Scribe in archivolt mould 2 *B* on joints *h d* and *n k*, and run the moulding through; clean in portion of pendentive *c f*—2 *C* intersecting with archivolt and forming obtuse mitre on the segment line *n* to *h*, and lastly, work panelled soffit.

Fig. 6.—No. 3 arch stone is worked in a similar manner to the foregoing No. 2 (Fig. 5).

No. 4, the key-stone, needs but little explanation, it being worked similarly to that of a right arch, with the exception of the mitre of the pendentive, which is here very obtuse and loses itself at *k*.

The section mould at each joint is 3 *B* (Fig. 6), taken to the dotted line.

Note.—The dotted lines shew the projection of coinciding points in the face and bed moulds of Figs. 4, 5, and 6.

The section of cornice directly under dome is shewn on Fig. 2, No. 6. A bed mould for this is required and also convex templets for the mouldings and fillets, these are obtained from the plan (Fig. 1), 6 *A* being the nose line.

The working of this stone presents no difficulty.

To work the Voussoirs in the Dome.

The shape of stone for working one of these is first, a rectangular prism, of the extreme length of the bed mould 7 *A* (Fig. 7), as shewn by circumscribed dotted lines *F F*, and of the height of joint mould 7 *B*, and second, that of a segment of a hollow cylinder, as shewn in sketch (Fig. 10), which contains the finished block.

Fig. 7.—7 *A* is the bed mould, and 7 *B* the section or joint mould of springer, or first stone in dome.

Begin by working the bottom bed *a e*—7 *B*, and scribe on the bed mould 7 *A*, the dotted line *A A* being the wall line on bottom bed, which must be worked fair to preserve the arris *a*. Work the joints *B D* square with the bed, and scribe in the joint mould 7 *B*. Work off the top bed *c d* and splay joint *c b*, a convex templet giving the arris *B B*, and lastly the concave surface of intrados *a b*.

The back *D D* is left rough.

Fig. 8.—To work the second stone in dome No. 8. 8 *A* is the bed mould, and 8 *B* the section, or joint mould.

Work the top bed, $b c d$ — $8 B$, and scribe in bed mould, $8 A$, to the extreme size, as $D D$, $B B$, the dotted line $A A$ being the horizontal arris of joint and soffit at a ; the line $C C$ top line of splay joint c ; and the line $B B$ the horizontal arris of joint and soffit at $b 1$.

Work the joints, $B D$ square with the top bed, and scribe in the joint mould, $8 B$; at points $B B$, at depth $b 1$, work a concave draft, and draw the horizontal line of joint and arris of soffit. Next work off the splay joint $c b'$, also the splay joint $a e$, and lastly the concave surface of intrados.

The back, $D D$. is left rough.

Fig. 10.—Shews a sketch of this stone completed.

It may be mentioned that the stones Nos. 2 and 3 (Figs. 5 and 6), previously described, are worked to one hand; for the opposite hand, the same moulds and templets will do, if reversed.

No. 5 (Fig. 2), is a plain spherical stone in the pendentive, and is worked similarly to those in the dome, as above described.

To construct a SPHEROIDAL DOME, with an aperture at the apex or top. The bed-joints are conical surfaces, and terminate on the extrados and intrados, in horizontal circles. The vertical joints are contained within a plane, which intersects with the axis of the dome.

Fig. 11.—Shews half-plan of the dome.

Fig. 12.—Shews section of the dome through the centre.

For the making of the moulds, and working this dome, a quarter only is necessary to be set out full-size, but in order to shew it more clearly the half is here given.

Begin by setting out on the plan (Fig. 11), the centre lines, $A C A$ and $C K$. With C as a centre and $C A$ as radius, describe the semicircle $A K A$, giving the extreme boundary of exterior surface, or extrados of dome. The thickness of the dome having been determined as $A B$, with C as centre and $C B$ as radius, describe the semicircle $B B$, as shewn by the dotted line, giving the extreme boundary of interior surface, or intrados of

DOME

FIG. 12

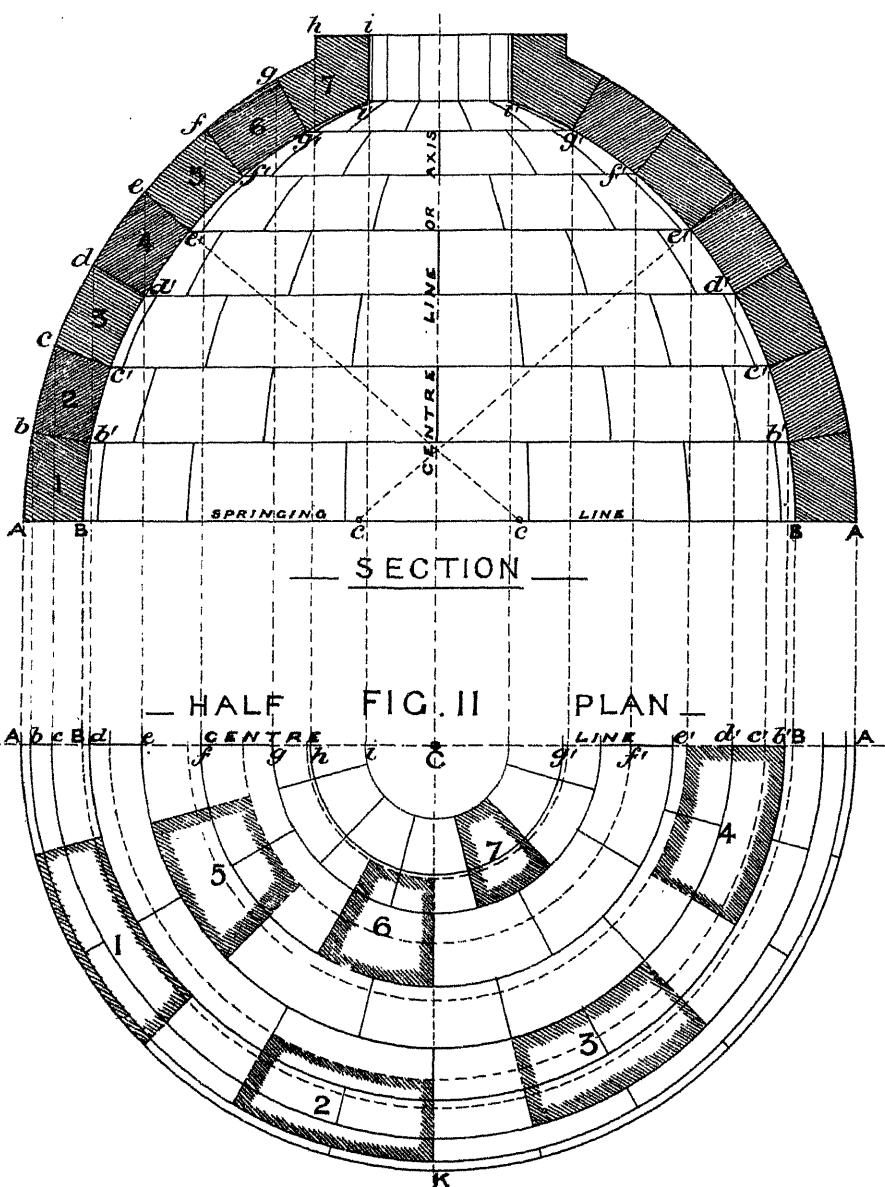


FIG. 14

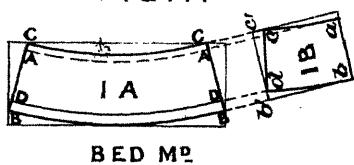
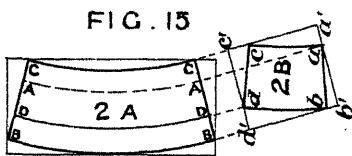


FIG. 15



dome. Project lines *A* and *B* to springing line, Fig. 12, and with *c c* as centres set up the section of dome, and divide the same into any number of equal parts for bed-joints as may be convenient (in this example, seven), as *b c d e f g*, and draw radiating lines for the joints from centre, *c*. Project *b c d e*, &c., on to plan (Fig. 11), and with *C* as centre describe semicircles *b c d e*, &c.; the plan of the arris of horizontal bed-joints on exterior is thus obtained. For the arris of horizontal bed-joints on interior surface, project *b c d e*, &c., on to plan, and draw the semicircles *b' c' d' e'*, &c., shewn by the dotted lines on right-hand half.

For the vertical joints each course will consist of the same number of stones (in this example, twelve), breaking joint directly over each other and diminishing in size from bottom to top course. These are set out on the plan.

The stones "hatched in" on the plan (Fig. 11), shew the projection of one voussoir in each course, as 1 2 3 4 5 6 and 7, and, being equal and similar stones, and alike in situation, one bed mould to each course only will be required.

To work the Voussoirs.

The shape of rough block required for working these stones by this method is a rectangular prism of the extreme length of the bed mould, as 1 *A* (Fig. 14), shewn by the circumscribed line, the height being that of the joint mould 1 *B*; and secondly, that of a segment of a hollow cylinder, as shewn in sketch (Fig. 17), which contains the finished block, the arrises only touching the boundaries of the cylinder.

Fig. 14.—1 *A* is the bed mould, and 1 *B* the section, or joint mould, of springer, or No. 1 stone.

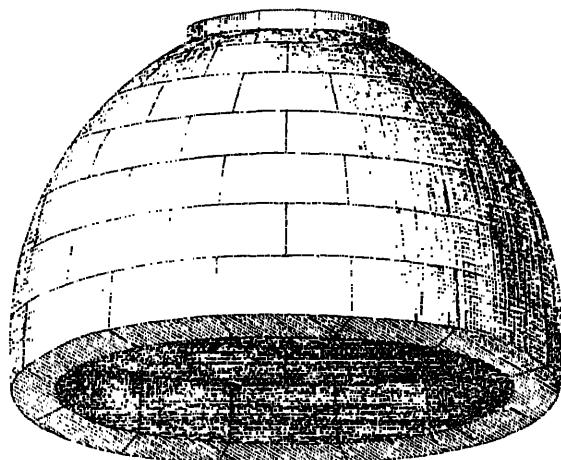
Begin by working the bed, *a b*—1 *B*, and scribe in bed mould 1 *A*. Work the joints *B C* square with the bed, and scribe in joint mould 1 *B*. Work the top bed *b' c'* as a surface of operation, and scribe in the line *D D*, which gives the top line of arris of convex surface and of splay joint. With the templet *C C* at *c* work the horizontal draft, giving the arris of joint and of concave surface. Work the top, *d c*, to lines as given, and the inside concave surface *a c*; and lastly, the outside convex surface, *b d*, using templets made at *a c* and *b d* for guidance.

Fig. 15.—To work the second stone (No. 2).

2 *A* is the bed mould and 2 *B* the section, or joint mould. Work the bottom bed *a' b'* as a surface of operation, and bed *d' c'* parallel to it.

DOME

FIG. 13



— SKETCH OF DOME —

FIG. 16

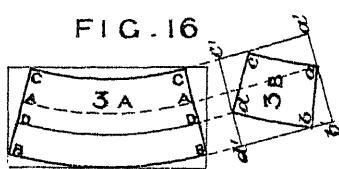


FIG. 17

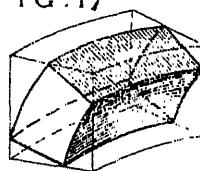


FIG. 18

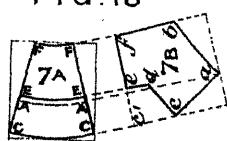


FIG. 19

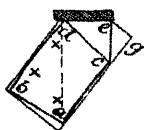
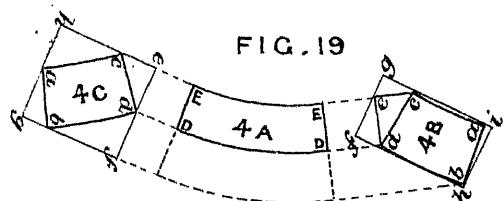


FIG. 20

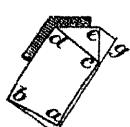


FIG. 21

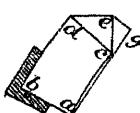


FIG. 22

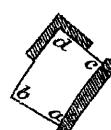


FIG. 23

Labour need not be thrown away on these surfaces, or beds, as the arris, *a a* on one bed and *d d* on the other, is all that is required to be kept fair; the other portion may be roughly chiselled off, and at the same time kept straight. Scribe in the bed mould on both beds, as *B C—B C*, and work the joints *B C* square with same; scribe in the joint mould, as *b a d c*, to each joint. With the templet *C C* at *c* work a horizontal draft, and draw a line parallel to *C'*, giving the arris of joint and of concave surface. With the templet *D D* scribe in line on the top bed, giving the arris of top joint and of convex surface. Work off the splay joint *d c* to the lines thus given. On the bottom bed, with templet *A A* scribe in line, giving the arris of bottom joint and of concave surface. With the templet *B B* at *b* work the horizontal draft, and draw line parallel to *b'*, giving the arris of bottom joint and of convex surface. Work off the splay joint to the lines thus given, and inside concave surface *a c*, and lastly outside convex surface *b d*, using templets made at *a c* and *b d* for guidance.

The stones in the other courses of the dome are worked in a similar manner to those last described, except the top course, or rim.

To work the Rim of Aperture in Dome, being the top, or No. 7, course.

Begin by working the top bed *c' f*, and scribe in the bed mould *7 A*. Work the joints *C F* square with bed, and scribe in the joint mould *7 B*. At *a* work a horizontal draft straight to *a*, and scribe in the templet *A A*, giving the arris of bottom joint and concave surface; then work the bottom joint and spherical surfaces *a b* and *c d e*.

There is some difference of opinion as to the best method of working the voussoirs in a dome, with respect to waste of material and labour. Perhaps for the first and second courses, and also the courses near the apex, no better method can be followed than the one just described, and, as before explained, in reference to vaulting, page 74. This method is simple, gives the best results, and the stones are truer in form when worked than by using a number of bevels. However, another method is here shewn, which saves much material and labour, although greater care is required in the execution.

Another Method of Working the Vousoirs.

Fig. 19.—Let 4 A be the bed mould of stone in fourth course of dome. (This being one of the courses in which there is much waste by the previous method of working, and is shewn by section 4 C, at line e f g h.)

For the joint mould, 4 B, transfer No. 4 from section (Fig. 12), as d c b a. Draw e d parallel and e c vertical to the base, or springing line; f g h i is a rectangle, circumscribing the mould and giving the size of stone required. When compared to that of 4 C, e f g h, the difference is at once seen.

Select a stone sufficiently large, so that all the surfaces and arrises are contained within it.

Fig. 20.—Begin by working a plane surface of operation, as e d, and apply templet 4 A, and scribe in as D E, D E. Work joints D E square with the bed; these require careful working, a portion of the joint being outside the line of square, as at X X X, but the one portion of joint having been worked, the other is obtained by means of the straight-edge. Apply joint mould to each joint, as d c b a, and scribe in.

Fig. 21.—Shews the next operation of working the convex spherical surface, by the guidance of a bevel, the stock of bevel being applied in the direction of a line radiating from centre C, as the joint lines E D—4 A.

Fig. 22.—Shews the third operation, the line b being drawn parallel to d; a bevel is used, giving the bottom splay bed, b a.

Fig. 23.—Shews the fourth and last operation, the angular portion, e g d c, being cut away and bevel used for splay joint; and the concave spherical surface is worked by the guidance of a templet made from a c.

It will be observed in the working of this stone that by this method the accuracy of the work depends almost entirely on the first plane surface of operation, and, should any errors occur in applying the bevels from this bed, the stone will not be of the shape and form intended.

The stones in other courses of dome may be worked in a similar manner.

PLATES XXXIV., XXXV., XXXVI., XXXVII.—
GROINED VAULTING.

To construct a GROINED VAULT, in four compartments, square on plan, and supported by a central shaft or column, with wall, transverse, and diagonal ribs.

Fig. 1.—Is the inverted skeleton plan of vault, shewing the general arrangement of compartments : *A A* being the wall ribs, *B B* the transverse ribs, crossing the vault at right angles to the wall, *C C* the diagonal ribs, spanning across from corners to the shaft, and *D D* the vaulting surface.

Fig. 2.—Shews the inverted plan of one compartment, or one quarter of the vault, with elevation of the wall, transverse and diagonal ribs, each being of equal height at the apex, and the ridge line of vaulting surface being also level throughout.

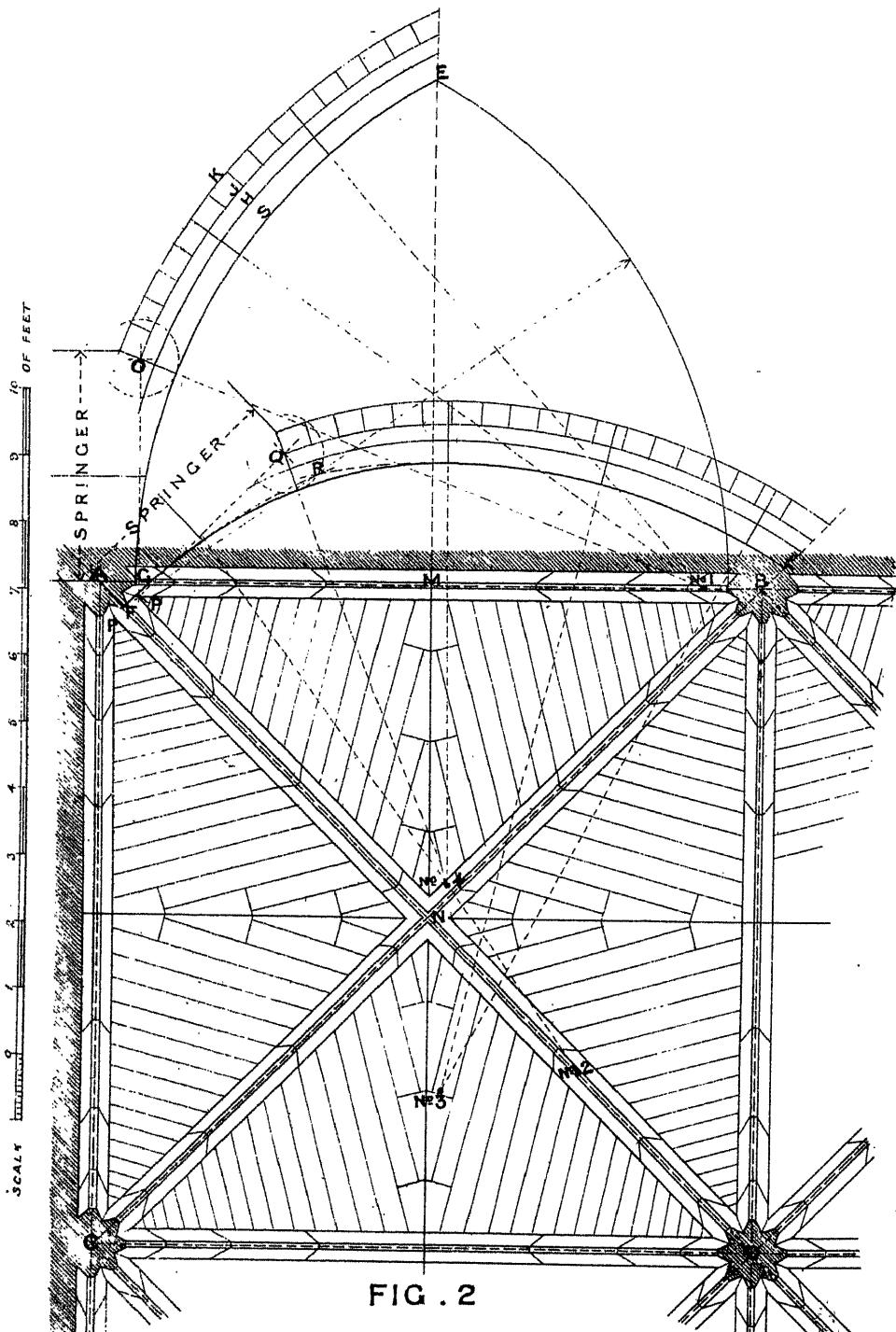
For the purpose of making the moulds, and the working of this vault, a small portion of the plan (one-sixteenth only), set out to full size, is all that is necessary, the remainder being a repetition ; but, in order to shew the setting out more clearly, a quarter of the plan is here given.

Begin by setting out the wall lines of vault, then the centre lines of wall ribs *A B* and *A C*, the transverse ribs *B D* and *C D*, and the diagonal ribs *A D* and *B C*, and set off on each side of the centre lines the width of their section.

Before proceeding further it is necessary to determine the position of the feet of ribs at the springing ; these generally depend on the plan of the abacus of cap, and it is also a matter of arrangement, as well as of taste and design, so that no fixed rule can be given.

In this example the ribs are arranged so that the nosings are equidistant from the point of intersection of the centre line of ribs at *A B C D*, in order that the wall ribs and transverse ribs may be of the same curvature, and also that the opening or span between the nosing of springers may be equal.

CROINED VAULTING



Having set out the position of the springers at *A B C D* on plan, the next process is to find the elevation or contour of the ribs. This is generally governed by the wall ribs, which have some opening or arch in the wall below them, regulating to some extent the form of vaulting. In some cases, perhaps, it may be preferable to begin with the transverse or diagonal rib, but this again depends on the shape of the vault.

In this example the contour of the transverse and wall ribs are similar, their span being equal, as before explained.

Begin by drawing the wall rib first. Take the centre line *A B* on plan, and make use of it as a base or springing line. Erect a perpendicular as a centre line at *M* on the plan, and on this set up the height of vault, as at *E*. Let point No. 1 be the centre from which the wall rib is struck, and with this as a centre, and nosing *G* as radius, draw the segment line *S* for the nose of rib on the soffit, cutting the centre line at apex *E*; gauge on the width of members of the rib, from the line of soffit *S* as *H J K*, and with the same centre, No. 1, draw the segment lines through these points, thus forming the wall rib. This is also the elevation of the transverse rib.

The profile of the diagonal rib is now to be obtained, and the first consideration is the shape of vault. If a horizontal section be taken through any one of the compartments, above the springers, and the vaulting, or filling in, between the ribs is rectangular in shape and parallel to the sides, the courses of stone forming the vaulting surfaces are level, and the upper edges of the diagonal ribs, upon which the filling-in rests, are portions of elliptic curves. These curves are obtained by ordinates, the curvature being subordinate to the wall rib; this is sometimes done, but as the elliptic rib entails more work both in the setting out and in the execution, the simpler method of using compound circular curves is generally adopted, and with perhaps better results constructively. The ribs are thus made geometrically regular, while the filling-in surfaces take their chance as it were, and are adjusted to the curvature of the ribs, and although twisting to some extent, yet do not offend the eye, which is guided mainly by the principal lines, and not the surfaces.

Another consideration is the separation of the ribs at one level, at the point where they become fully developed. The more equally the ribs can be grouped together at the springing, without projecting at unequal distances before each other, the better it is for their separation or clearance; the advantage of this being, that the winding in the vaulting surface is much reduced, and is free from that ploughshare-like twist, to which objection is sometimes made. The ribs are also equal in depth and of the same cross section, and the setting out and the working generally are easier. In

some cases it may be impossible to do this, and the ribs are then arranged to suit the conditions of the case.

In this example the contour of the diagonal is struck from centres, and these may be varied to suit any adjustment of curvature.

The point at which the feet of ribs is struck should be on the springing line, neither above nor below, for if above the rib would be stilted, and if below an acute angle would be formed with the springing line, neither of which results is pleasing.

Let $A D$, the centre line of diagonal rib on plan (Fig. 2), be the base or springing line for the elevation of rib; produce the centre line $C B$, which is perpendicular to $A D$, as the centre line of elevation, and on this set up, from the base line to the apex of the soffit of rib, the height $N L$, equal to the height $M E$ on the elevation of the wall rib. Next in the elevation of wall rib, find the point of clearance, or where the rib separates from the springer, and the full section of rib is obtained; this will be the point in the upper edge of the rib vertically over the point where the sides of the rib intersect at P on plan. At P erect a perpendicular to the springing line $A B$, cutting the upper edge of rib at O in elevation, which is the point of separation, or where the wall rib is fully developed, and clears the springer. Through the same point P , erect a perpendicular to the springing line $A D$ on the diagonal, and set off the height $F Q$, equal to the height at wall rib of $G O$; the diagonal rib thus clears the springer at point Q , the back edge of the rib at vaulting surface.

Two points are already given in the curve of the diagonal rib, namely at F , the springing, and at L , the apex, but a third is required. Now at point Q describe an arc with radius equal to the depth of the rib as at O , and it will be at once evident that the arc furnishes a point through which the curve of rib must be drawn. Commence on the springing line $A D$, and find a centre by which the curve may be drawn from F , to touch the arc whose centre is Q , but as this throws the curve too high, and would make a cripple, find a centre, No. 2, that takes the curve still higher, that is to R as shewn by the dotted line. Now find a centre as No. 3, and draw curve to R from the apex L . An intermediate radius is now required, by which a curve may be drawn touching the arc whose centre is Q , and intersecting the other curves Nos. 2 and 3. This is found at No. 4, and the curvature of the diagonal rib thus obtained is easy and graceful, retaining also the pointed form. Gauge on the width of members of the rib from the line of soffit, and with their respective radii draw curves forming the elevation of the diagonal rib.

CROINED VAULTING

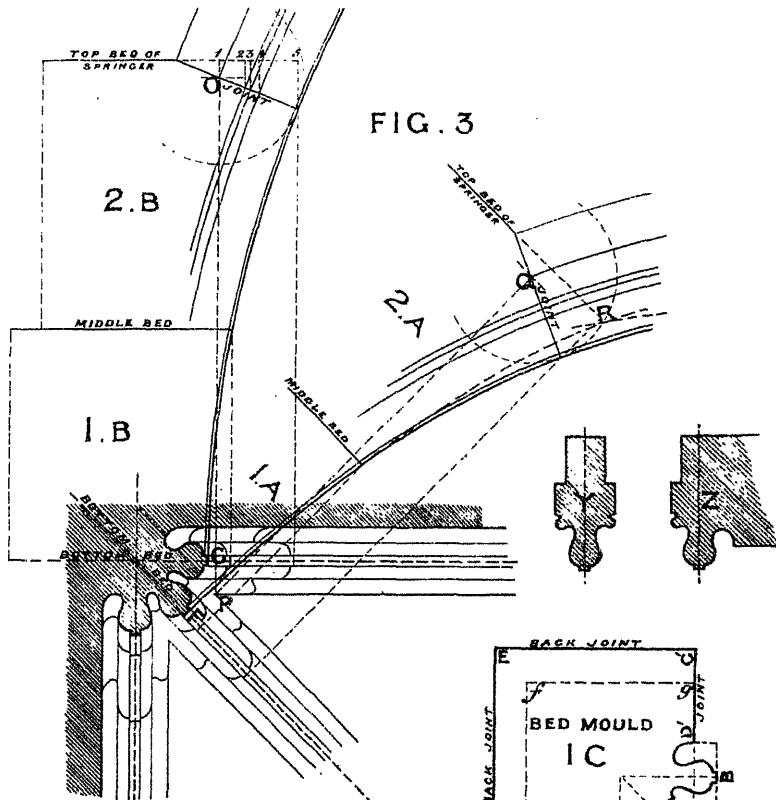


FIG. 3

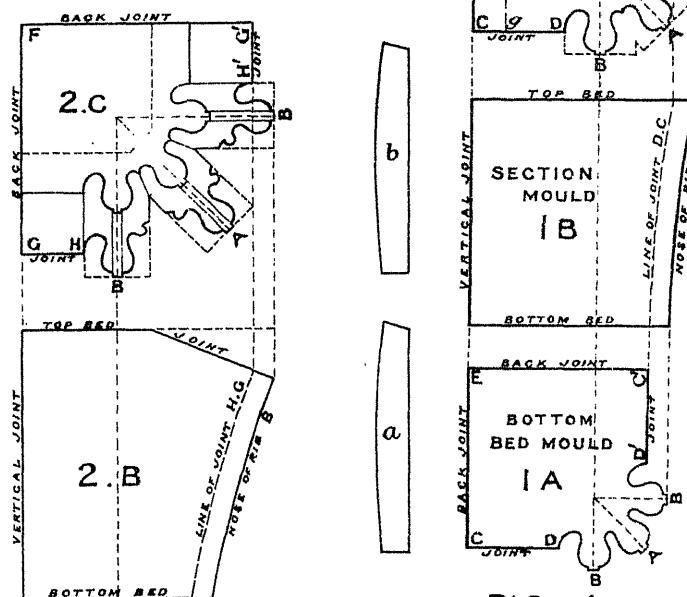


FIG. 4

FIG. 5

The radii and centres are best found by repeated trials.

The next thing to be done is to arrange the joints of the springers and ribs, and the filling-in to the vaulted surfaces.

The joints of the springers are usually worked in horizontal or level courses, except a portion of the top bed, where the ribs separate and are fully developed; this portion is inclined or splayed from the level bed, and abutment joints are thus formed which radiate to their centres.

The joints for the ribs may be drawn to any convenient length to suit the size of stones, and they must radiate to the centres from which that part of the rib is struck.

The diagonal ribs which intersect at the apex and form the key are the same in curvature, and will properly mitre into each other; the arms or stumps at each side of the intersection are drawn at will to any convenient length.

The filling-in to the vaulted surfaces is in narrow bands of stone, four or five inches wide, and with beds slightly radiating. These bands start from the point where the ribs separate at the top of springers, and are continued in parallel courses until they meet obliquely at the apex, taking then the form of key blocks; these key blocks are rack shaped, and derive support from the bands which abut against them, and also rest on the wall ribs and mitre junctions in the centre of the vault. The filling-in bands being narrow on the face the twist to each stone is so small as to be scarcely perceptible; moulds may be made to these if desired from the elevation of wall and diagonal ribs, but the twist on the stones is usually worked on the scaffold at the time of fixing, this being the most economical way. The key blocks also are simple in construction, the making of moulds and working of the stones presenting no difficulty.

Attention may now be directed to the setting out in detail and to the working of the various stones.

Fig. 3.—Shews the setting out of the springers to a larger scale. The section moulds for diagonal and transverse ribs are given at Y, and that of the wall rib, which is slightly different on the wall side, at Z.

The centre lines having been drawn, the section moulds of ribs Y and Z are applied until the position of the ribs is arranged equi-distant from the point of intersection of the centre lines, as before explained.

The notation is the same as that of Fig. 2.

Fig. 4.—Shews the bed and joint moulds of No. 1, or bottom stone in springer.

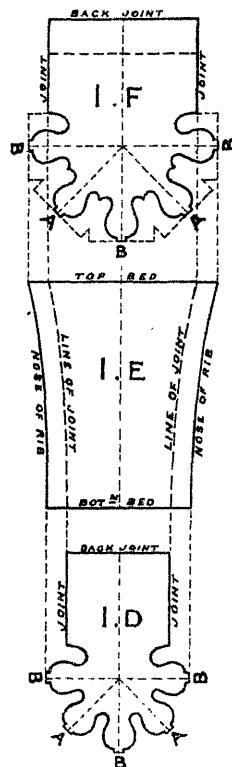


FIG. 6

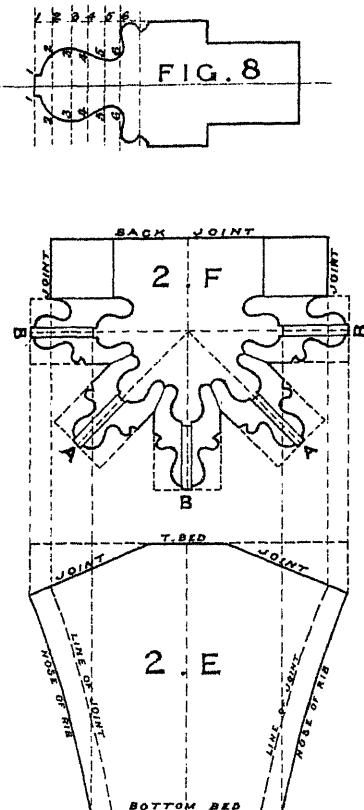


FIG. 7

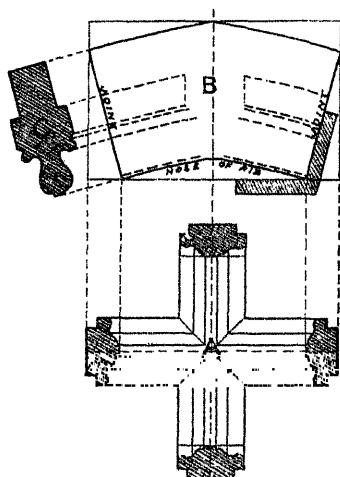
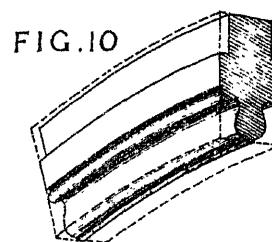


FIG. 9



SKETCH OF RIB

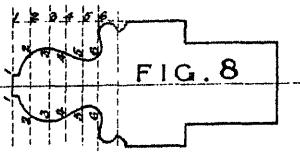
SCALE OF FIGURE 1 INCHES
0 1 2 3

FIG. 8

1 A is the bottom bed mould, 1 C is the top bed mould or middle bed (this also will be the bottom bed mould of No. 2, or upper stone in springer at dotted line $g f g$), and 1 B is the section mould taken through the centre line of wall rib.

Commence by working the back joints E C and E C' (which may be taken as surfaces of operation), and scribe on the section mould 1 B on each joint. Work the bottom and top beds square from back joint, these being parallel to each other, and scribe in the bed moulds 1 A on bottom bed and 1 C on the top bed. Work the two concave joints C D and C' D', guided by a convex templet, and the nosing of rib from A to A and the nosing of ribs B to B, guided by the convex templets a and b. The moulding is now to be worked, using small reverses and templets for guidance.

Fig. 5.—Shews the bed and joint mould of No. 2 or upper stone of the springer.

1 C (Fig. 4) is the bottom bed mould, 2 C is the top bed mould, and 2 B is the section mould taken through the centre line of the wall rib. Work the back joints F G and F G', and scribe on the section mould 2 B on each joint. Work off the bottom bed square from the back joint, scribing on the bed mould 1 C (Fig. 4) to the dotted line $f g$; next work off the top bed square from the back joint and parallel to the bottom bed, and the splay joint seating for the wall rib, as given by section mould 2 B, also the splay joint for the seating of diagonal rib. The bevel for this may be obtained from 2 A (Fig. 3) or the nose line may be squared down from the top bed and the depth gauged on. On the centre lines of the top bed scribe on the section of rib moulds Y and Z. Work the two concave joints G H and G' H', also the nosing of rib from A to A and the nosing of ribs from B to B, guided by convex templets. The moulding is now carefully worked, using small reverses and templets for guidance.

The springers when worked will truly mitre from the springing to the separation of ribs.

Care must be taken that the centre lines of the ribs are vertically over one another, or in the same vertical plane, as shewn in Fig. 5—2 C, in which the mould No. 1 C for the bottom bed is marked on, and again in Fig. 7—2 F, where the mould 1 F, for the bottom bed, is also marked on.

The moulds should always be made this way with the sections vertically over one another.

It will be observed in the bed mould 2 C (Fig. 5) that although the

moulding to ribs is given it is only approximate, and cannot be worked to accurately, because it is here foreshortened, and consequently a little distorted. This may be seen by reference to Fig. 3, the plane at 1, 2, 3, 4, 5 being that to which the mouldings are projected from the splay joint. The position of nosing, however, is correctly given, starting square down at the depth of the splay joint from the horizontal bed.

The section of the rib moulding at the middle bed, or at any horizontal line of the springer, may be obtained by projection. Divide the square section of the rib into any number of parts as in Fig. 8 at 1 2 3 4 5 6. Set off these points on the elevation of the rib, and from the centre draw the segmental lines through, cutting the horizontal line or bed; transfer these points of intersection to the centre line of the rib on plan, and draw lines through square from the centre line, and make them equal to 1 1—2 2—3 3, &c., of square section, and draw the curves through these points, giving the true section at horizontal level.

Fig. 6.—Shews the bed and joint moulds of springers of No. 1 or bottom stone at *B* and *C* on the plan (Fig. 2).

1 *D* is the bottom bed mould, 1 *F* is the top bed mould, and 1 *E* is the section mould taken through the centre line of wall rib *B B*.

Fig. 7.—Shews the bed and joint moulds of No. 2 or upper stone of springers at *B* and *C* on the plan (Fig. 2).

1 *F* (Fig. 6) is the bottom bed mould, 2 *F* is the top bed mould, and 2 *E* is the section mould taken through the centre line of wall rib *B B*.

The moulds for the central springer at *D* on the shaft are identical with the last-named (Fig. 6 and Fig. 7). The centre line at *B B* being half of the mould, this half scribed on the stone and then reversed for the other half, gives a completed whole.

These last-named springers are worked precisely as those already described, the same templets as before being used for the nosing of ribs and concave joints.

Fig. 9.—Shews the bed and section mould of the key-stone at the intersection of the diagonal ribs. *A* is the bed mould, *B* is the section mould, taken vertically through the centre, and *C* is the section mould of the rib.

Work a plane bed as a surface of operation, and scribe in the bed mould *A* on the soffit. Work off the splay joints to bevel, and scribe in the section mould of rib *C* on each joint; work out the square checks on each side of ribs, and cut the nosings to a concave shape, guided by convex templets. Now run the mouldings in on each stump to their intersection, forming mitres, cut off the back if required, and take out the rebate for vaulting surfaces.

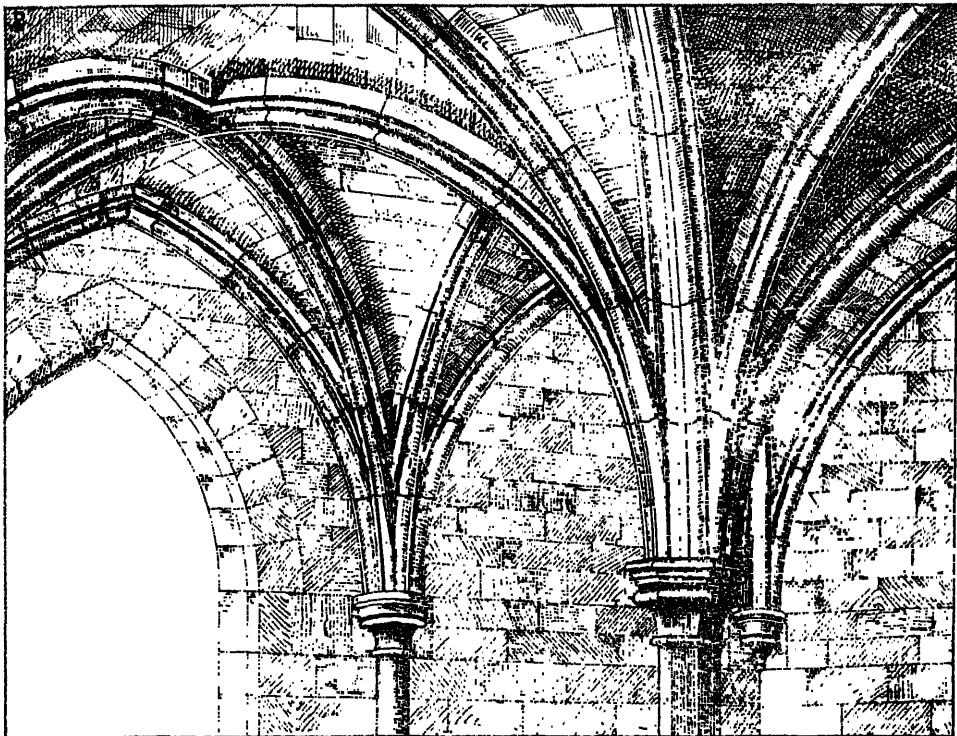
Fig. 10.—Shews a sketch of the rib.

The working of this requires but little description, it being treated as a simple arch stone. A plane surface is first formed; on this the face mould is scribed, and the joints which radiate from the curve of the soffit are then squared through, and the section mould of rib is scribed in on each joint. The stone is next worked to a parallel thickness, the rebate for vaulting surface being taken out and the moulding run through, guided by convex templets and reverses.

Fig. 11.—Shews a sketch of part of the vault.

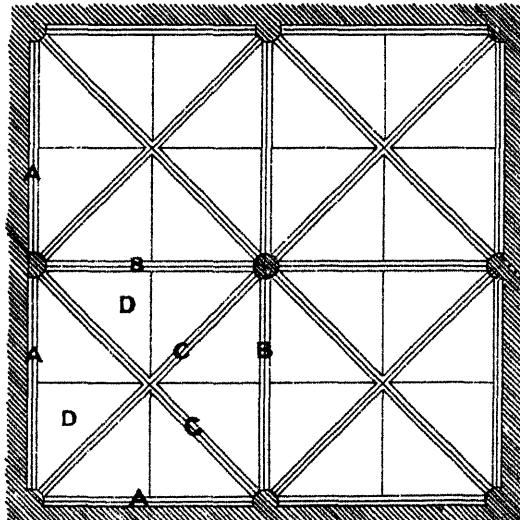
GROINED VAULTING

FIG. II



SKETCH OF PART OF VAULT

FIG. I



PLAN OF VAULT

PLATES XXXVIII., XXXIX., XL., XLI.—GROINED VAULTING.

(Continued.)

To construct a GROINED VAULT, square on plan, with wall, diagonal, intermediate and ridge ribs.

This vault is somewhat different to the one previously shewn on pages 89 and 90, in having intermediate ribs, ridge ribs, and bosses.

Ornamental bosses are introduced into these vaults, as it is not possible to nicely mitre the mouldings of the ribs, at the intersection of the apex or ridge, on account of the differing inclinations of the ribs. The mouldings, therefore, die into the bosses, and the difficulty is got over. The bosses also give strength and richness to the vault.

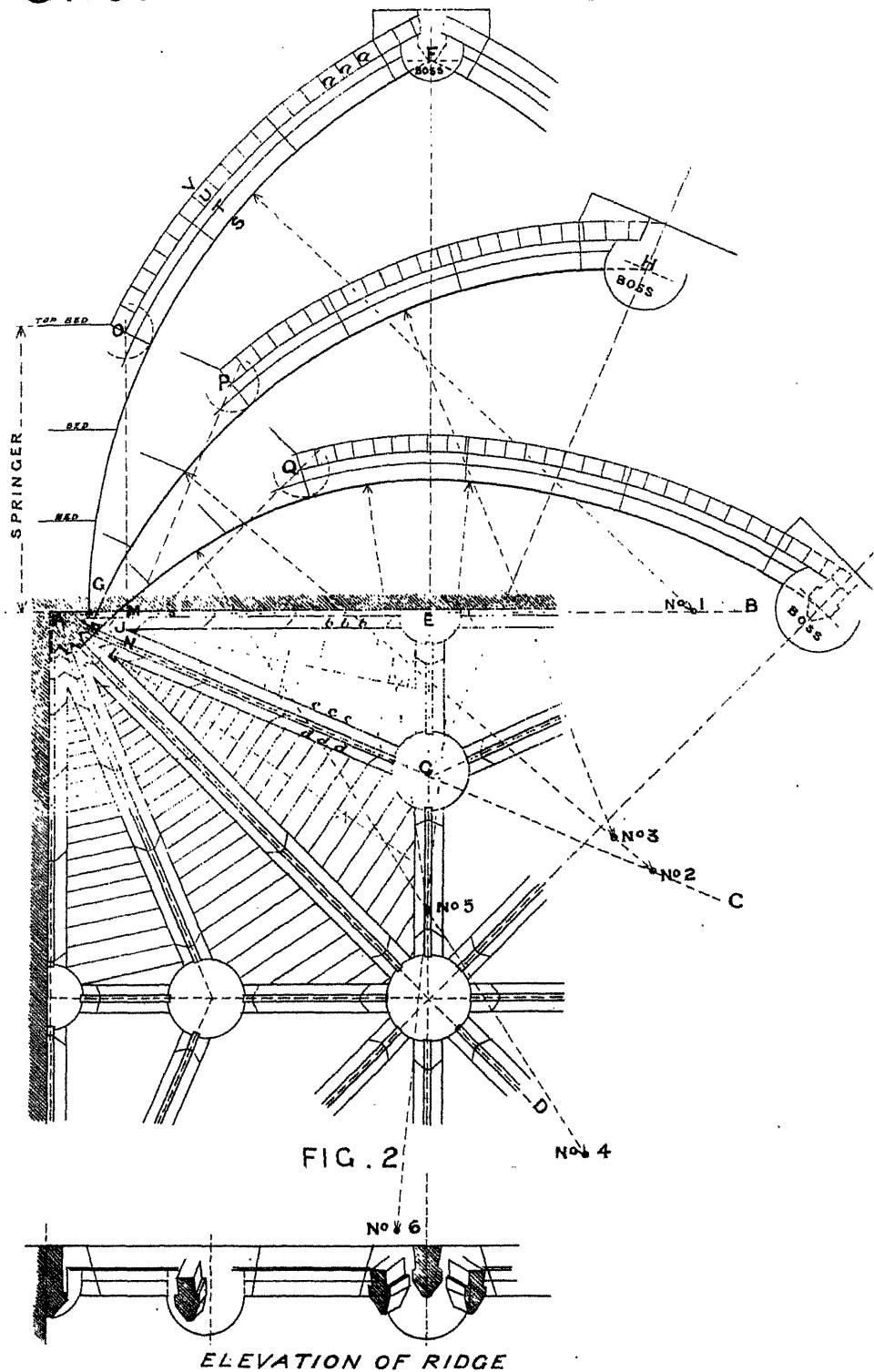
Fig. 1.—Is the inverted plan of vault, shewing the general arrangement of ribs, *A A* being the wall ribs, *B B* the diagonal ribs, *C C* the intermediate ribs, *D D* the ridge ribs, and *E* the vaulting surface, or filling in, and *F* the bosses.

Fig. 2.—Shews the inverted plan, of one quarter of the vault, with elevation of the wall, diagonal, intermediate, and ridge ribs, each being of equal height at the apex, and the ridge ribs being also level throughout.

For the purpose of making the moulds and working the vault, only one quarter is necessary to be set out, the remainder being a repetition. Begin as previously described on page 89 by setting out the wall lines of vault, then the centre lines of wall, ridge, intermediate, and diagonal ribs, and draw circles for bosses, at the intersection of ribs.

Determine the position of the feet of ribs, at the springing line, as shewn at Fig. 3. The noses of these ribs are arranged so as to touch a segmental line (the abacus of cap upon which the springer rests being segmental). Gauge off on each side of the centre lines the width of ridge, intermediate, diagonal, and wall ribs; the first three are equal, but the

GROINED VAULTING



wall ribs are only a little more than half the width of the others, in order that the nosings should be of one size.

To complete the portion of the plan, the filling in, to the vaulted surface, must now be set out.

Narrow bands of stone, or chalk, of various widths, but generally parallel, are mostly used. In the spandrel pieces on the plan, between the wall and intermediate ribs, and intermediate and diagonal ribs, the joints are set out at right angles to a line bisecting the angle formed by these ribs.

Space out these bands, on the rebate line of wall rib, on the elevation Fig. 2, as at *a a a*, and project on to the side of the wall rib on plan, as at *b b b*; draw the joints at right angles to the line of bisection, which produce to side of the intermediate rib as *c c c*. Square the joints across this rib as shewn at *d d d*; the points thus obtained give the position of the bands, between the intermediate and the diagonal rib, which are drawn similarly to the preceding.

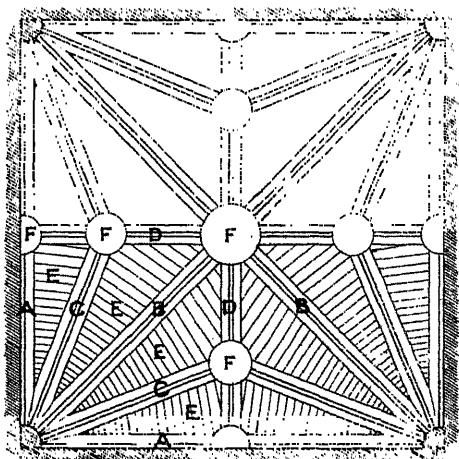
The next process is to find the elevation, or contour of ribs, which in the present example is governed by the wall rib, and this regulates to some extent the form of vaulting.

Begin by drawing the wall rib, taking the centre line *A B* on plan as a base or springing line, then at *E*, the centre of side of vault, erect a perpendicular as a centre line, and set up the height of vault as at *F*. Point No. 1 is the centre from which the wall rib is struck, with this point as a centre, and the distance to nosing *G* as radius, draw the segment line *S* for the nose of rib on the soffit, cutting the centre line at the apex *F*, which may be also called a datum line, this line being the height to which all the ribs are drawn. Next gauge on the width of the members of rib, from the line of soffit *S*, as *T U V*, and with the same centre No. 1 draw segmental lines through these points, thus completing the wall rib.

The elevation of the intermediate and diagonal ribs is now to be obtained, and the first consideration is the separation of the ribs at one level. This separation of the ribs is of primary importance both in the working and the setting out, and has been fully explained in the previous section, page 91.

For the elevation of the intermediate rib, commence on the centre line of rib *A C* on the plan, and at *G* erect a perpendicular to *A C* as the centre line; on this set up the height *G H*, equal to *E F*, on the elevation of the wall rib.

FIG. 1



SCALE 0 1 2 3 4 5 OF FEET

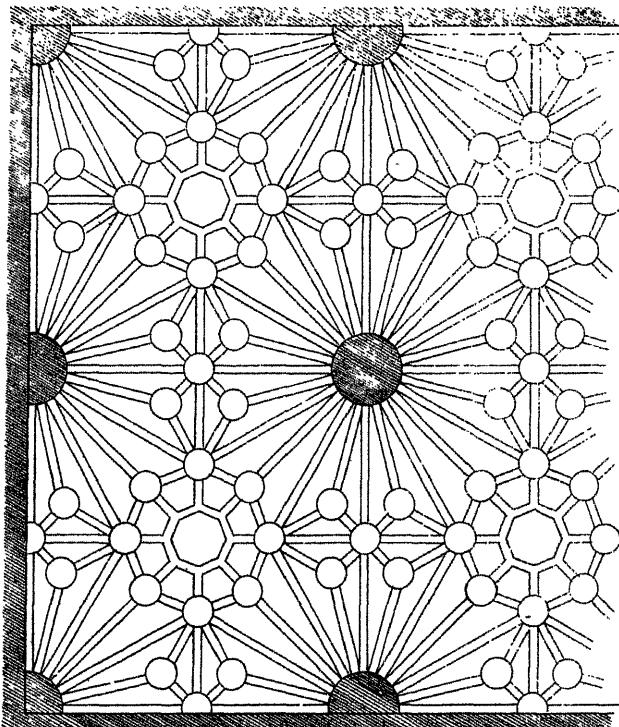


FIG. 8

Next find the point in the elevation of the wall rib, where the rib clears itself and separates from the springer. At *J* erect a perpendicular to the springing line *A B*, cutting the upper edge of the rib at *O*, in elevation, which is the point of separation of the rib, or where it is fully developed, and clears the springer. Through the same point *J* erect a perpendicular to the springing line *A C* on the intermediate rib, and set off the height *N P*, equal to the height of wall rib at *M O*. The intermediate rib thus clears the springer at point *P*, the back edge of rib at vaulting surface. Two points are already given in the curve of the intermediate rib, namely, at *R* the springing, and at *H* the apex, but a third is required. Now at point *P* describe an arc, with radius equal to the depth of the rib as at *O*, containing a point through which the curve of rib must be drawn. Commence on the springing line *A C*, and find by trial a centre, and draw the curve from *R* to touch or approach the arc, whose centre is *P*. Find a centre No. 2, and draw the curve from *R* towards the arc, and with centre No. 3 continue the curve to apex *H*. From the line of soffit gauge the width of members of rib, and with centres Nos. 2 and 3 draw the curves, forming the elevation of the intermediate rib. Care must be taken that the curves are regular, and that cripples are avoided.

The elevation of the diagonal rib is to be next obtained, and the method adopted is similar to the foregoing, or as in the preceding example, page 92. Centres are found by trial, as at Nos. 4, 5, and 6, and the curves drawn from them.

The next thing to be done is to arrange the joints of the springers, and the ribs, and these may be drawn to any convenient size. The joints of the ribs, above the springers, radiate to their respective centres, and the joints of the springers will have horizontal beds.

The moulds and templets for the springers are made, and the stones worked similarly to those already described in preceding example, pages 94, 96, 97.

The ridge ribs and the bosses have now to be described, for the purpose of making the moulds, and working of the stones.

Fig. 4.—Is the bed mould and sections of the central boss stone, *A* being the bed mould, *B* the section mould, through the centre of the boss, and curved ribs, and *C* is part section mould, through the centre of boss,

FIG. 3

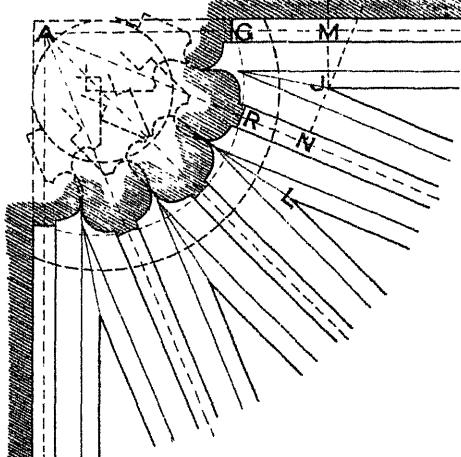
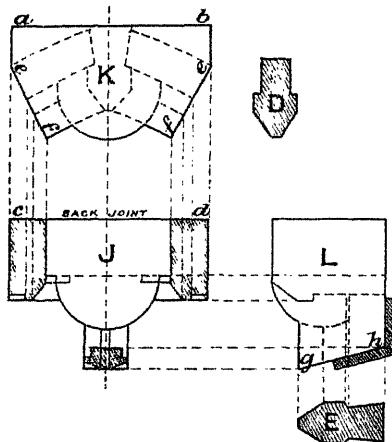


FIG. 6



SCALE OF 1 2 3 4 5 6 7 8 9 10 11 12 INCHES

FIG. 4

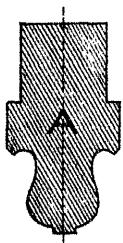
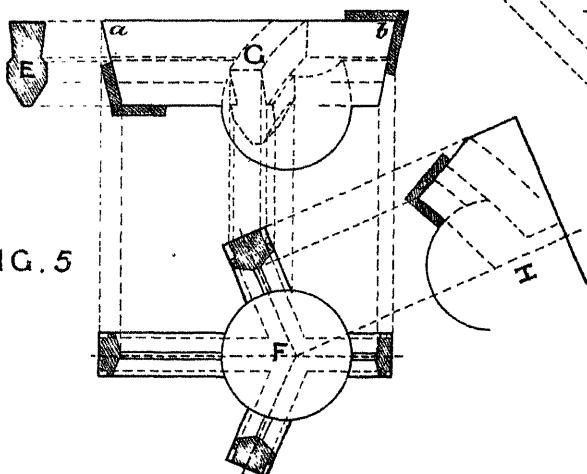


FIG. 5



FOR DETAILS

SCALE 0 1 2 3 4 OF FEET

and ridge ribs. It will be seen that neither of these last two moulds can be applied direct on the stone, but are used to obtain the bevels of the joints, curvature and position of the ribs, and contour for the carving, as well as to shew the true form at those sections.

The stumps, or arms, in this example are perhaps longer than they need be, but are here emphasised to shew more clearly the working. The four joints of the diagonal ribs radiate to their centres, and form a key, the other four joints are arranged so as to form skew backs, upon which the ridge stones are supported.

There are several ways of working these boss stones, and the one now to be described is similar to that adopted by the old Gothic masons, which has also simplicity to recommend it. There must necessarily be waste of stone as well as labour, whatever method is chosen.

First form a plane surface of operation, as *a b* on the section *B*, so that when fixed, this bed is horizontal, and on this scribe in the bed mould *A*. Work off the splay joints *e f* to receive ridge, the bevel being obtained from the section *C*, and the radiating joints *c d*, for the diagonal ribs, getting the bevel for these from section *B*, scribe in the section mould of rib *E*, to splay joint for the ridge, and the section mould of rib *D*, to the radiating joint for the diagonal ribs. Now work the stumps and mouldings in against the boss, using templets made from section moulds *B* and *C* for guidance.

The boss may be shaped out and carved before fixing, or left rough from the point, and carved after fixing, the latter method being generally adopted.

Fig. 5.—Is the bed mould and sections of intermediate boss stone, and part of the ridge, *F* being the bed mould, *G* the section mould, through the centre of the boss and ridge rib, and *H* part section mould through the boss and intermediate ribs. Neither of these last two moulds can be applied, but are used for the purpose of obtaining bevels, curvature, and position of ribs, &c., as in the case of central boss stone (Fig. 4.)

First form a plane surface of operation, which will be horizontal, as *a b*, on the section *G*, and on this scribe in the bed mould *F*, then rough the stone out to shape and work off the joints, the bevels being obtained from the section moulds *G* and *H*, scribe in the section moulds *E*, for the ridge rib, and *D* for the intermediate ribs. Next work the ribs in against boss, and complete the mouldings; the boss may be treated as in Fig. 4.

Fig. 6.—Shews the bed mould, and also sections of key to ridge and wall ribs, *J* being the bed mould, *K* and *L* the section moulds.

First form a plane surface of operation, which is horizontal as *a b* on the section *K*, and on this scribe in the bed mould *J*, work off the vertical back joint *c d*, and scribe in the section mould *K*, and work the splay joints *e f* through for wall ribs. Next work the splay joint *g h*, by aid of bevel taken from the section *L*, and scribe in the section mould of ribs, cut ribs in against boss, and complete the mouldings. The boss may be treated as in Fig. 4.

In Fig. 3, at section *A*, the mouldings to ribs are shewn, but in the other figures these mouldings are represented by a chamfer, on account of the smallness of the scale to which they are drawn.

On the plan of the springing (Fig. 3), the letters are identical with those at the springing on the smaller scale (Fig. 2), in order that the reference to them may be more clear.

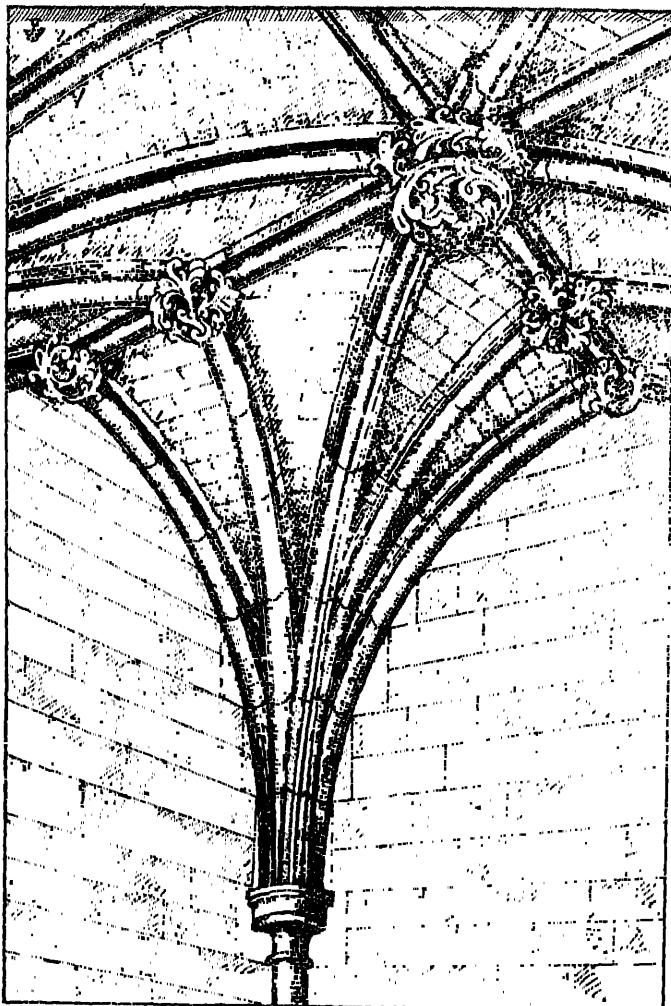
Fig. 7.—Shews a sketch of part of the vault.

Fig. 8.—The extent to which vaulting of a complicated nature may be carried out is shewn in the plan here given of part of the vaulting at the Members' private entrance, House of Commons.

The student may be reminded that the examples here given of groined vaulting deal only with a small portion of this intricate subject, but it is hoped that the general principles have been sufficiently illustrated, so as to enable him to deal with other cases as they come before him.

GROINED VAULTING

FIG. 7



SKETCH OF PART OF VAULT

PLATES XLII., XLIII., XLIV., XLV., XLVI.— TRACERY WINDOWS.

TRACERY WINDOWS are of the most extensive variety, both in design and form, and require no little consideration and study on the part of the student. The correct carrying out of the designs for such works affords valuable evidence of the mason's skill.

Without going into the principles governing the composition and design of tracery, it may be remarked that, with few exceptions, geometrical tracery is based upon the combination of the equilateral triangle with the polygon and circle; and the examples here given will mostly illustrate this particular style.

In setting out tracery windows generally, commence by drawing the vertical centre line of window, then the springing line at right angles to the same, and set off the span, or opening, and draw segment line of the arch. Divide the span for small openings, and draw in the mullions. This may also be obtained from the plan if first drawn. Now draw in the construction lines for centres of tracery to the required design, care being taken that the curves must properly intersect with each other, or be drawn tangential, as the case may be. The mouldings which form the mullion, on taking a curved shape in the tracery, are termed monials.

Gauge on from the centre lines of tracery last drawn the width of monial, giving the lines of nosings, fillets, splays, &c., and complete the window by drawing the foliations, eyes, and cusps.

The joints of all tracery windows should be drawn in to radiating lines from the centres, by which the principal curves of monials are drawn; this is not always possible, but the rule should be borne in mind.

For the purpose of making the moulds, one half the window only is necessary to be set out.

Fig. 1.—Shews the constructional lines of completed window (Fig. 2). The equilateral triangle $A B C$, divided into four similar figures $d d d$,

TRACERY WINDOWS

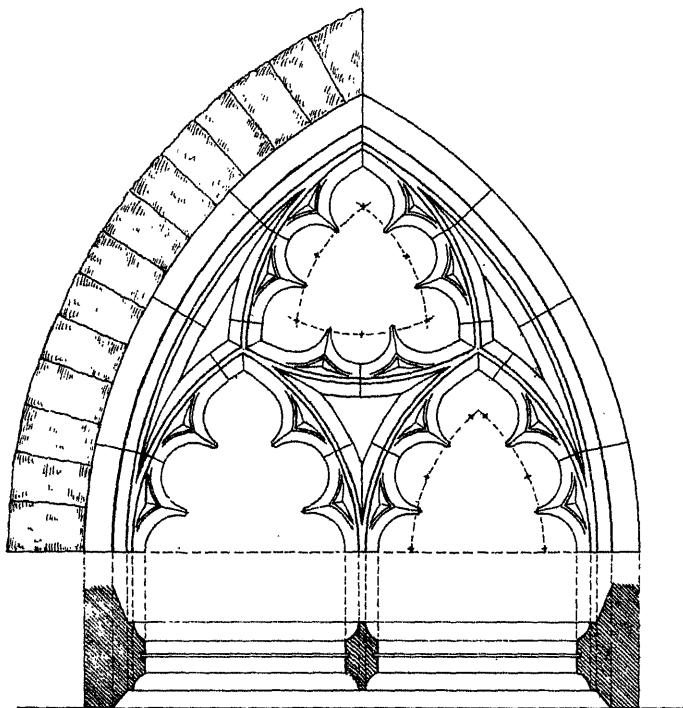


FIG. 2

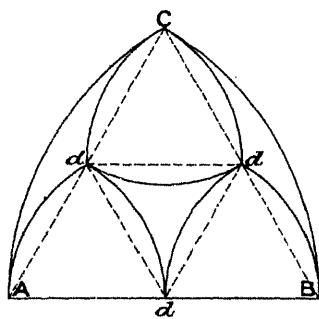


FIG. 1

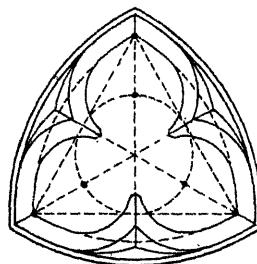


FIG. 3

TRACERY WINDOWS

FIG. 5

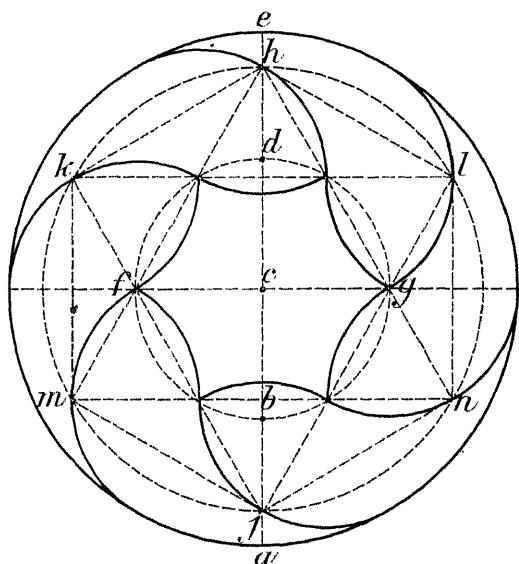
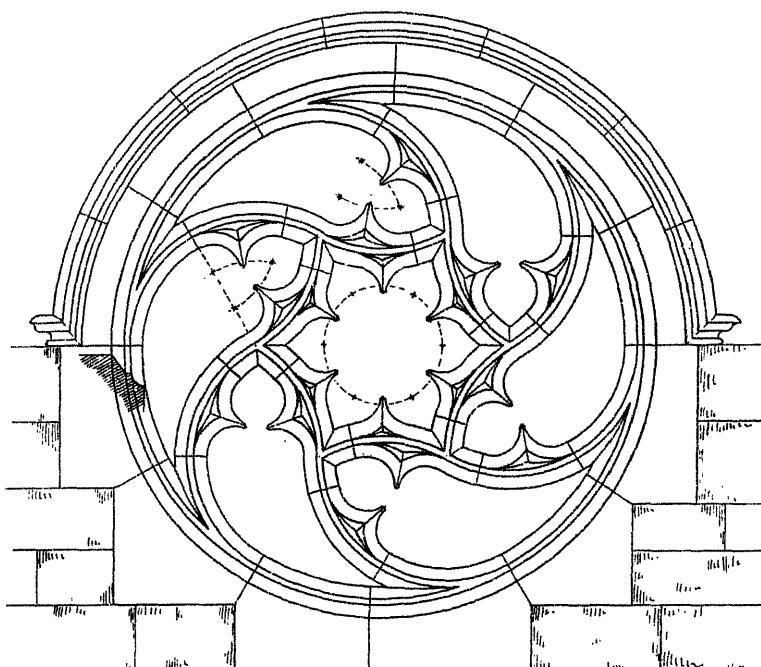


FIG. 4

gives the centres for the tracery. This is again exemplified in Fig. 8, which shews the trefoil, the centres of which are evident, and need no description.

Fig. 4.—Shews the constructional lines of circular window (Fig. 5).

To construct the figure, divide the diameter into four equal parts, as at *b c d e*, and with *c* as centre and *b* or *d* as radius, describe a circle, and inscribe a regular hexagon, intersecting with the opposite diameter at *f g*. The points of intersection will give one half of the centres of tracery.

On the diameter at *f g*, as a common base, construct the two equilateral triangles *f g h* and *f g j*, and with *c* as centre, and *h* or *j* the apex, as radius, describe a circle, and inscribe the hexagon *h j k l m n*, or produce the equilateral triangles, cutting the circles in these points. These give the other half of the centres, for completing the main lines of tracery.

Fig. 5.—Is the completed window, with foliations, eyes, and cusps, and label moulding.

It may be observed, that four face moulds, with a slight modification in two of them, will work all the tracery in this window.

Fig. 6.—Shews the elevation and part plan of window, the right-hand half in elevation, shewing constructional lines, and the left hand the completed half of window.

This will be understood without further instruction than is afforded by the illustration.

Fig. 7.—Shews the elevation and part plan of window, the right-hand half in elevation shewing constructional lines, and the left-hand the completed half of window.

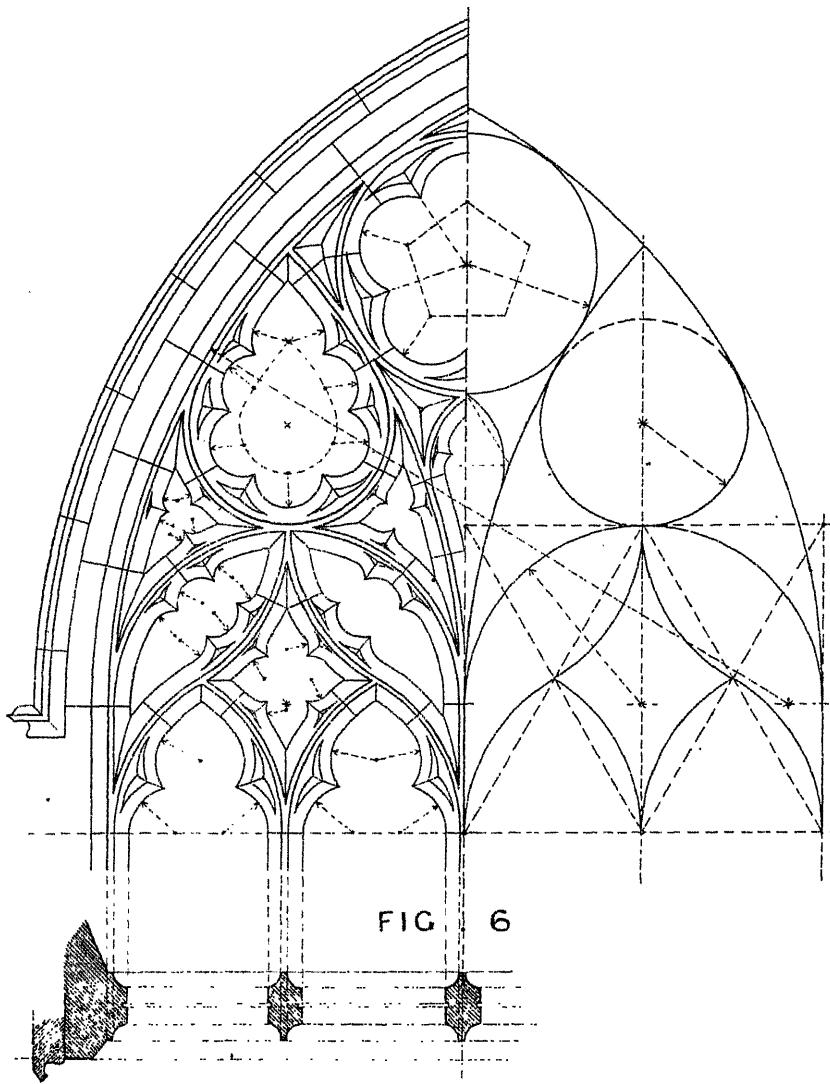
The geometrical constructive lines are not so marked or apparent in this window, yet it has a purely geometrical expression, the trefoil and circle predominating.

This example has been chosen to illustrate the working of one of the stones, which is typical of the working of each of the others.

Fig. 8.—Shews face mould of the springer *A*, transferred from elevation (Fig. 7). *B B* are section moulds of main mullions, *C* is section mould of mullion, or bottom bed, of springer, and *D* is section mould of small mullion; this applies to the two branch joints.

To work the springer, commence by working a plane, as a surface of

TRACERY WINDOWS



SCALE 10' 6" 0' 1' 2' 3' ↑ OF FEET

TRACERY WINDOWS

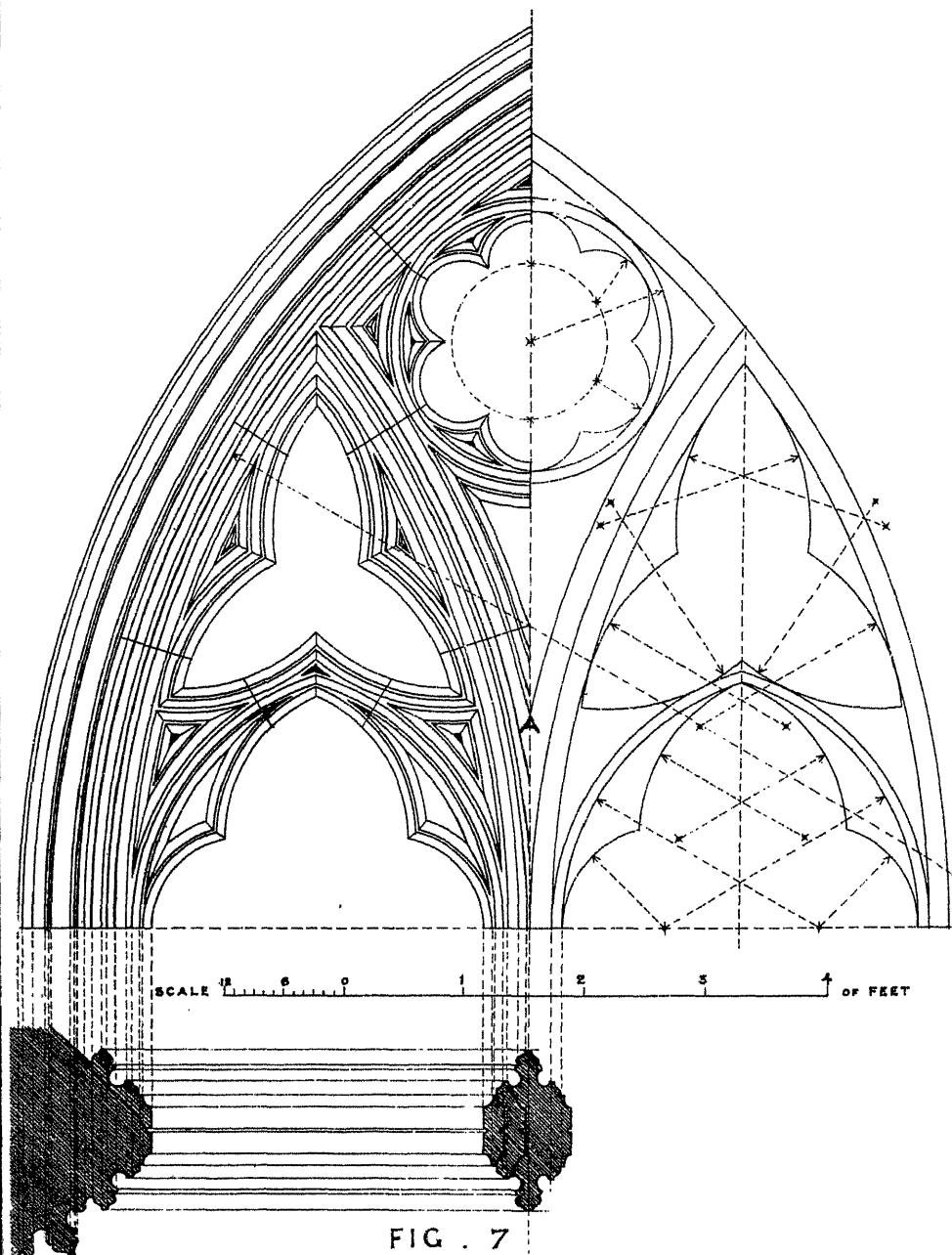


FIG . 7

operation, and on this scribe in the face mould *A*, marking-in the nosings *a a b* by the aid of a templet, the nosings being the only portion of the plane not cut away. Next point the stone roughly to shape of the face mould, and then take it to a parallel thickness, equal to the thickness of the section mould *B* or *C*. Now work the joints through square from the face, and scribe in joint moulds *B D* and *C* on their respective joints. Then work through the nosing *a a* and *b*, and boutel mouldings, and fillets, and sink down the whole of the remainder of face to lower nosing *c c c*, scribe in on each side of nosing the skeleton face mould (Fig. 9), and work the soffits through to shape. Sinkings are now made for the several mouldings, the eyes of cusps are pierced, and the stone finished to its correct shape, templets and reverses being used in guidance.

Fig. 9.—The using of the skeleton mould, here illustrated, saves the working through of the soffits, from the outside, or first surface of operation.

The section moulds for monials, in several cases, will require a little widening out, as at *D*, and these may be projected from the face mould. The reason for this is, that the joints are not always on a true sectional line.

Fig. 10.—Shews sketches of various examples of cusps, which require no explanation.

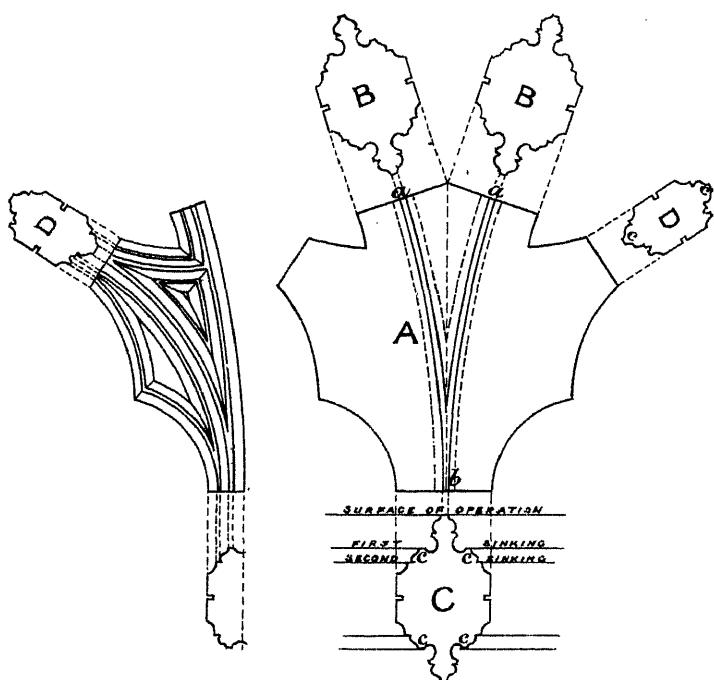


FIG . 9

FIG . 8

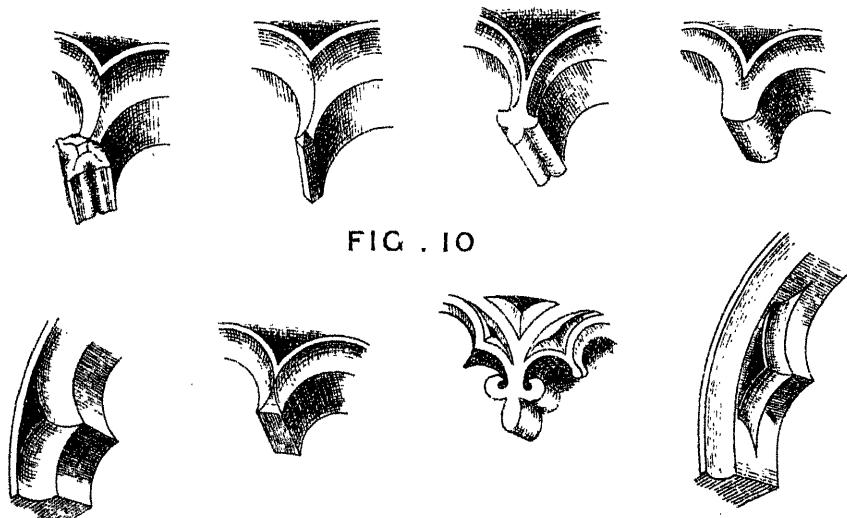


FIG . 10

SKETCH OF CUSPS

PLATES XLVII., XLVIII., XLIX., L.—GOTHIC MOULDINGS.

The profiles of mouldings here given are indications of the various styles or periods, and are of great interest to the student of Masonry, and also because they attest the working skill of the mason.

The characteristics generally of each period and the dates are briefly as follows :—

Norman, 1066 to 1189.

The mouldings consist chiefly of chamfers, round, and quarter round members, with shallow hollows, the edge roll or bead being the principal member. These are frequently entirely covered with ornament, such as the chevron or zigzag, the billet, the lozenge, the double cone, the star, the pellet, and others, producing great richness of effect.

Early English, 1189 to 1300.

In this period the mouldings are bold and deeply undercut, and generally arranged on rectangular planes; they are composed chiefly of the bowtell and keel members, with a combination of fillets and deep hollows of irregular curves, resulting in a beautiful effect of light and shade. The curves of these mouldings are easy and graceful, and are usually drawn by hand, the compasses being little used.

The principal ornament of these mouldings is the dog-tooth, which is greatly varied, and belongs exclusively to this style.

Decorated, 1300 to 1377.

The mouldings in this style are bold and well-proportioned, and arranged on rectangular as well as diagonal planes. The rounds and hollows are not so deeply cut as in the preceding style, the hollows being segments of circles, the deeper hollows being confined to the inner angles; the roll moulding, the quarter round, and wave moulding are also very much used in combination of the groups.

The ornament is chiefly the ball flower, of which there are several varieties, and the four-leaved or diaper flower; these are nearly as characteristic of the Decorated style as the tooth ornament is of the Early English.

Perpendicular, 1377 to 1547.

This style is characterized by mouldings which have large and shallow members, and generally a large hollow in the centre of each group, and arranged on diagonal planes. Another feature of this style is the constant use of beads of three-quarters of a circle and also flat wave mouldings; to this may be added the absence of fine detail.

The common ornaments are the Tudor flower, rose, and fleur-de-lys cresting, an example of the last-named being given on Plate 50.

GOTHIC MOULDINGS.

PROFILES OF GOTHIC MOULDINGS.

Norman Period, 1066 to 1189.

1 to 5. Cushion caps of various forms, principally from Peterborough Cathedral.

6 to 14. Bases, various.

15. Base from nave, Worksop Priory.

16. Arch mould from transept, Peterborough.

17. Arch and label mould from nave, Tutbury.

18. " " " Southwell.

19. " mould from transept, Peterborough.

20. " and label from mould nave, Worksop Priory.

21. " " " Wenlock Priory.

22. " " " transept, Peterborough.

23. " " with various enrichments.

24 to 29. Strings, various.

30. The sunk star ornament.

31. " billet "

32. " square billet "

33. " lozenge "

34. " double cone "

35. " chevron or zigzag.

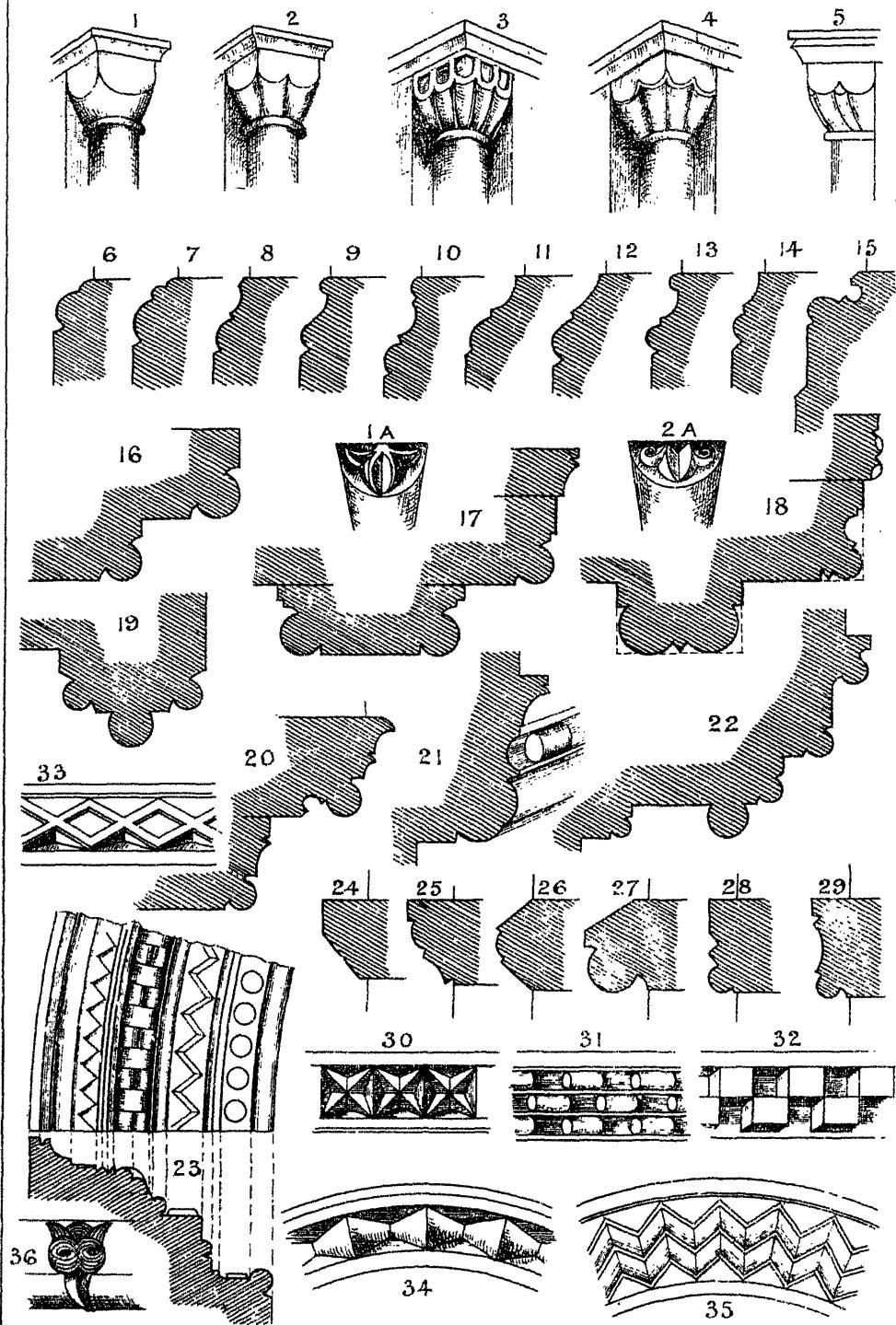
36. " beakhead.

1A, 2A. Ornament in caps, Worksop Priory.

GOTHIC MOULDINGS

PLATE. XLVII.

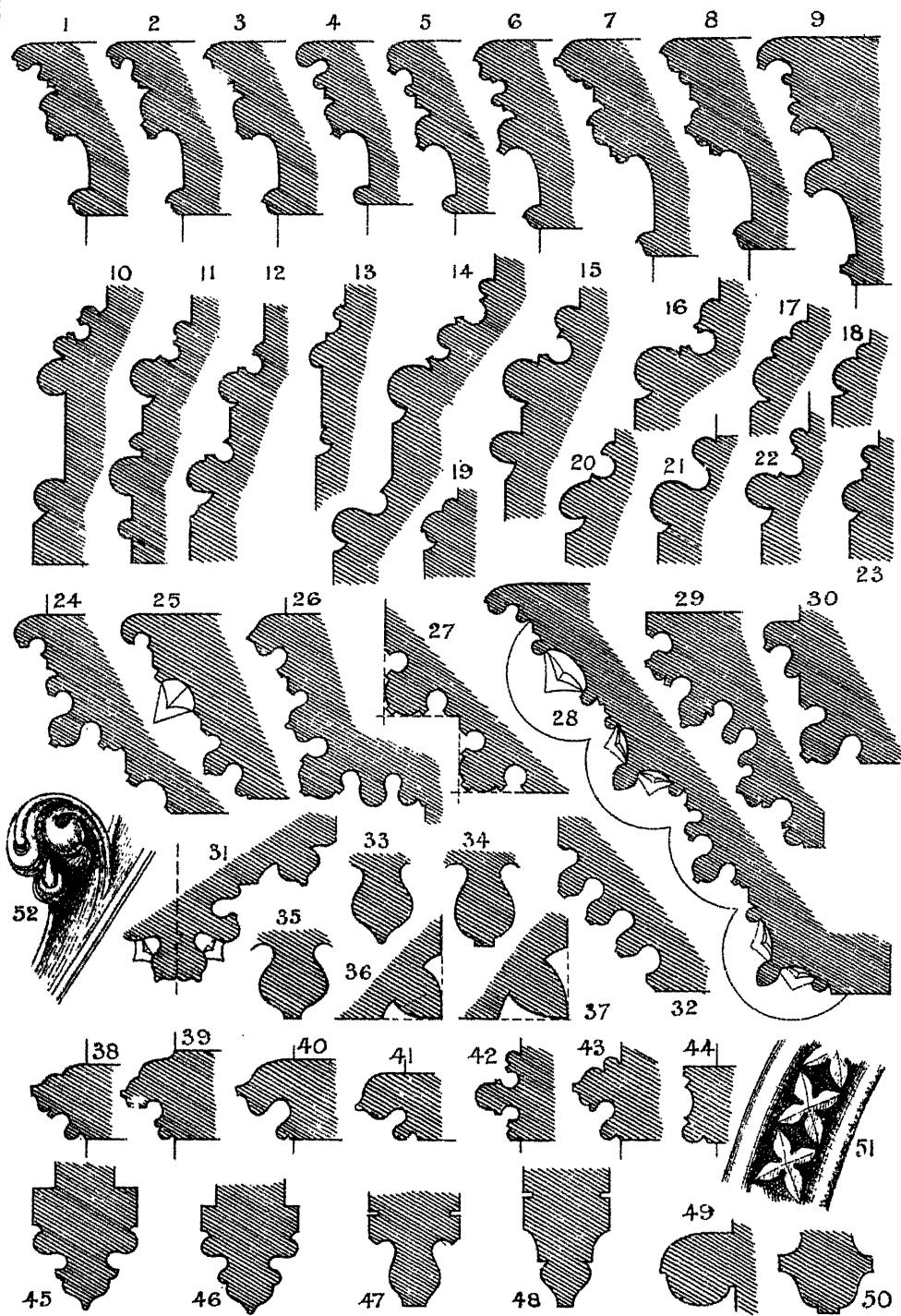
NORMAN PERIOD — 1066 TO 1189.



GOTHIC MOULDINGS.

Early English Period, 1189 to 1300.

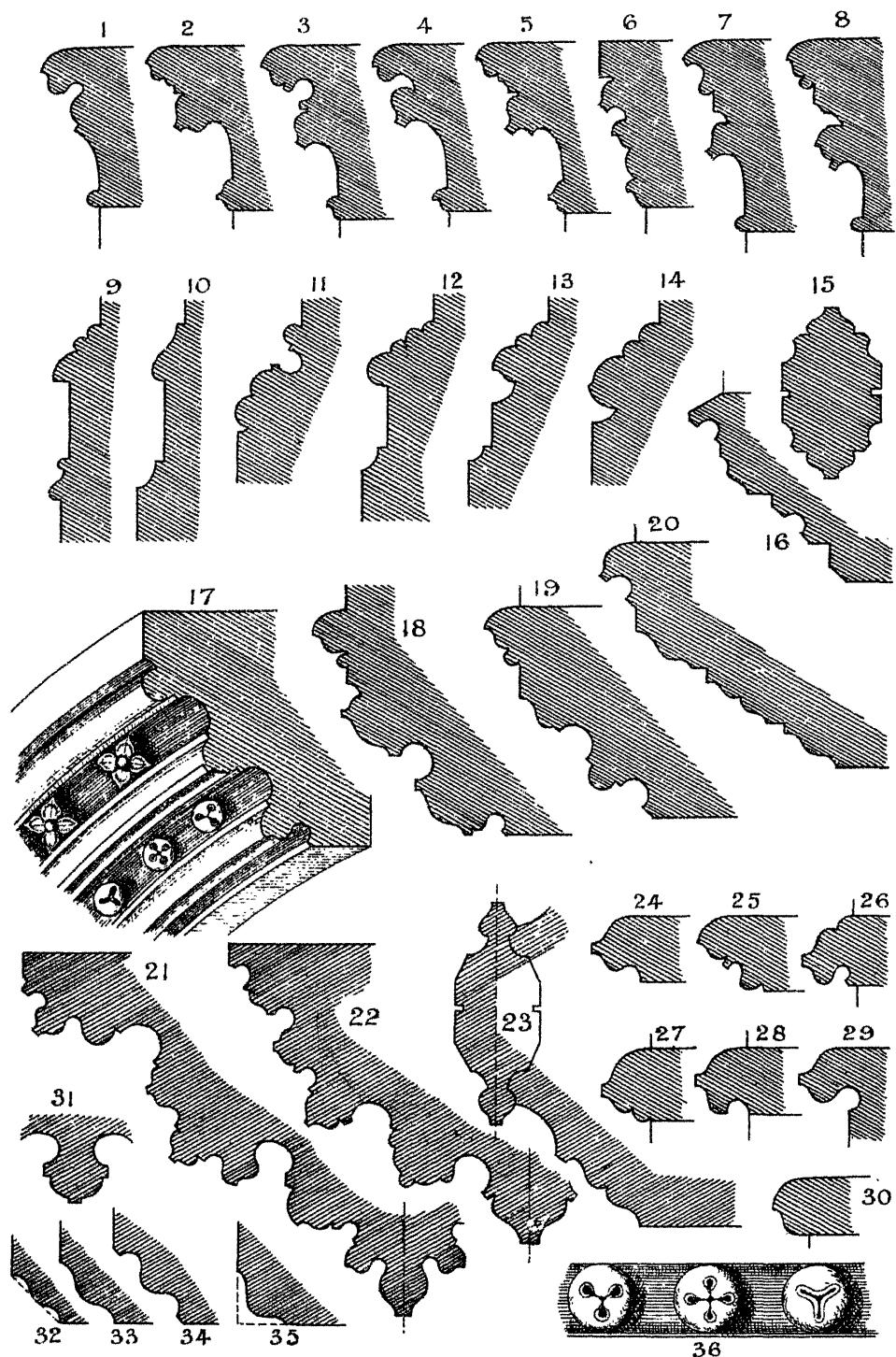
- 1, 2, 3. Caps from Westminster Abbey, Triforium.
- 4 and 6. " " Bolton Abbey.
- 5, 7, 8. " " various.
9. " " from Carlisle Cathedral.
10. Base from Carlisle Cathedral.
11. " Ely "
12. " Peterborough Cathedral.
13. " Cowling, Kent.
14. " Lincoln Cathedral.
- 15 to 19. Bases, various.
20. Base from Warmington, N. Hants.
21. " Durham Cathedral.
22. " Lincoln " Arcade.
23. " Bolton Abbey.
- 24, 25. Arch and label moulds, Warmington, N. Hants.
26. " " Carlisle Cathedral.
27. Jamb mould.
28. Arch and label moulds, Warmington, Doorway.
29. Arch mould, Lincoln Cathedral, Arcade.
30. " Langham Church, S. Transept.
31. " Beaulieu, Hants.
32. "
- 33, 34, 35. Bowtell mouldings.
- 36, 37. Keel mouldings.
- 38 to 44. String mouldings, various.
- 45, 46. Rib mouldings.
- 47, 48. Mullion.
49. Scroll moulding.
50. Roll and triple fillet.
51. Dog-tooth ornament.
52. Crocket "

—EARLY ENGLISH PERIOD— 1189 TO 1300—

GOTHIC MOULDINGS.

Decorated Period, 1300 to 1377.

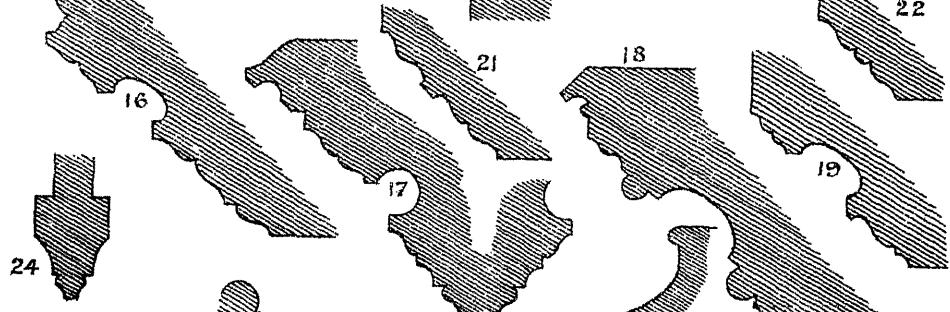
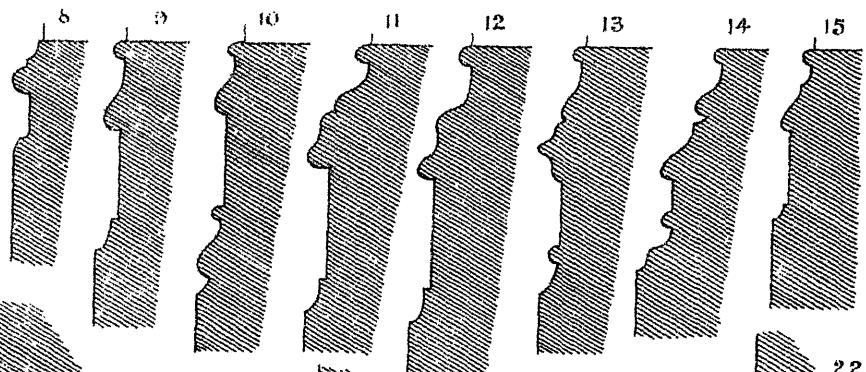
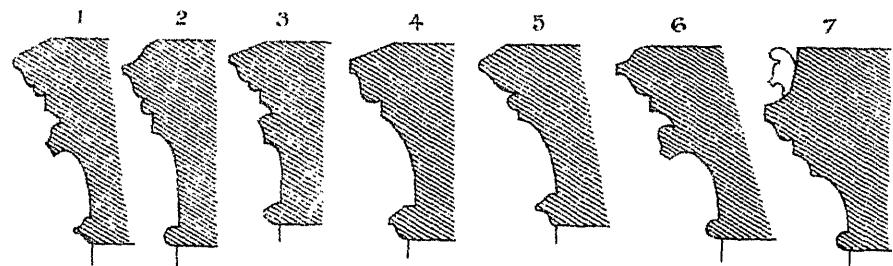
1. Cap from Irthlingborough.
- 2 to 8. Caps, various.
- 9 to 14. Bases, various.
15. Mullion.
16. Jamb mould.
17. Arch mould with ornament of ball flower and four-leaved or diaper flower.
- 18, 19, 20. Arch and label moulds.
21. Arch mould from Lichfield, Choir.
22. " " " Stafforid, Nave.
23. Jamb " " Holbeach Church, Lincolnshire.
- 24 to 30. String and label moulds, various.
31. Triple filleted roll.
- 32 to 35. Varieties of wave mouldings.
36. Ball-flower ornament, three varieties.

DECORATED PERIOD — 1300 TO 1377 —

GOTHIC MOULDINGS.

Perpendicular Period, 1377 to 1547.

- 1 to 7. Caps, various.
- 8 to 15. Bases, , ,
- 16. Arch mould and label from Chester Cathedral.
- 17. " " Newark, Nave.
- 18. " " "
- 19. Jamb mould.
- 20. Pier " from St. Stephen's Cloisters, Westminster.
- 21. Wave moulding.
- 22. " "
- 23. Mullion, St. Stephen's Cloisters.
- 24. Rib moulding " "
- 25. Buttress moulding.
- 26 to 33. Strings and labels, various.
- 34. Sill mould, Christchurch.
- 35. Cresting ornament.

— PERPENDICULAR - PERIOD - 1377 TO 1547 —

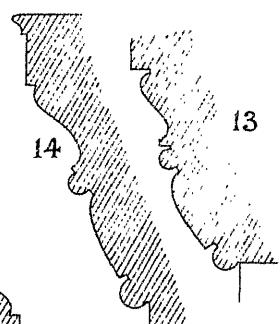
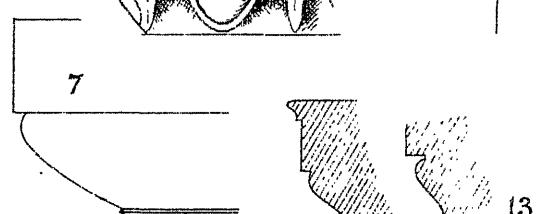
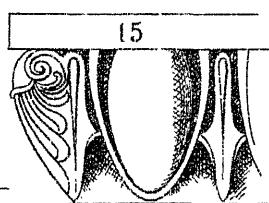
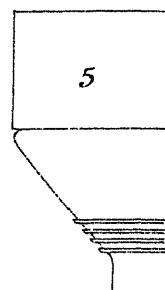
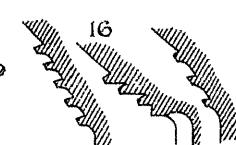
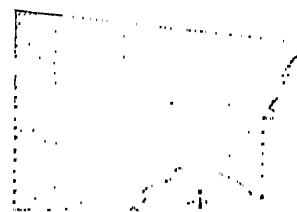
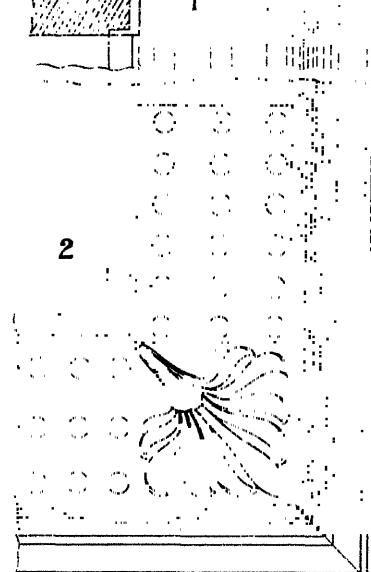
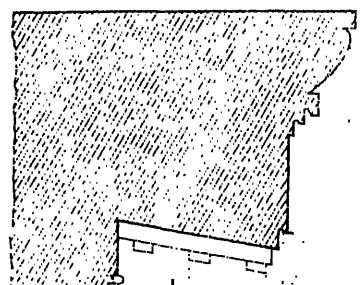
GRECIAN MOULDINGS.

The profiles of these mouldings are composed of lines of varying curvature, and mostly correspond to conic sections, embracing the hyperbola, parabola, and ellipse. It is considered, however, that they were drawn by hand, and not obtained by any mechanical method.

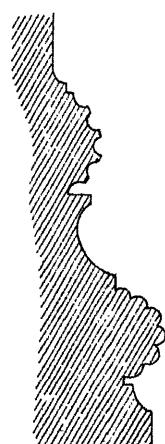
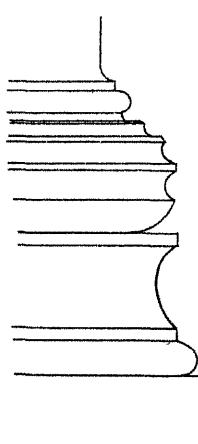
The examples here shown are taken chiefly from the works of Sir William Chambers and Inwood.

1. Section of the Doric cornice from the Parthenon.
2. Plan of external angle of ditto, looking up, showing the mutules and honeysuckle enrichment.
3. Section of Ionic cornice from the Erechtheum.
4. ,, ,, ,, ,, ,,
5. Doric cap from Samothrace (Hyperbola).
6. ,, from the Theseum (Parabola).
7. ,, from Selinus (Ellipse).
8. Ionic base from the Temple on the Ilyssus.
9. ,, from Minerva Polias.
10. ,, from Prienne.
11. Corinthian base from Monument of Lysicrates.
12. Capital of Antæ from Erechtheum.
13. ,, ,,
14. ,, ,,
15. Egg and tongue enrichment.
16. Annulets or neckings to Doric caps.

Note.—It may be here observed that the columns of the Greek Doric have no base, but are planted direct on the square step which is a feature of this particular style of building.

—GRECIAN MOULDINGS—

14



12

8

9

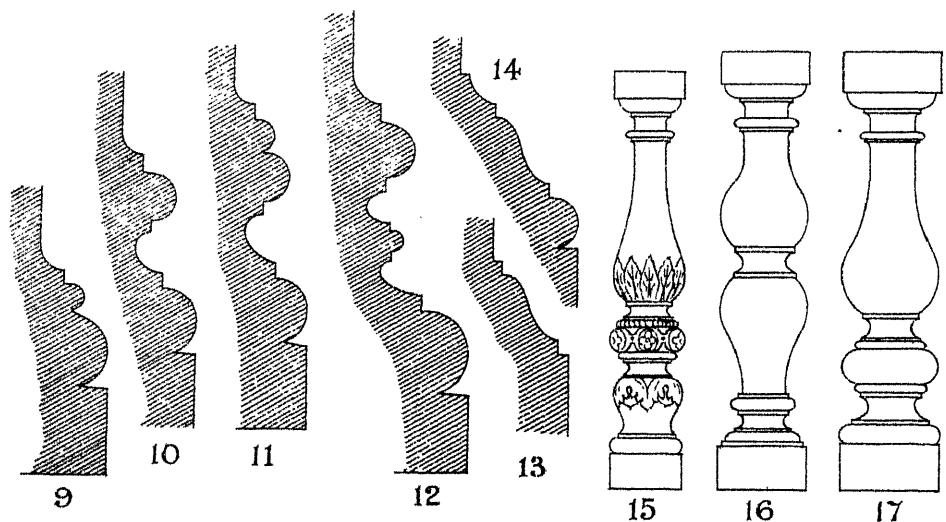
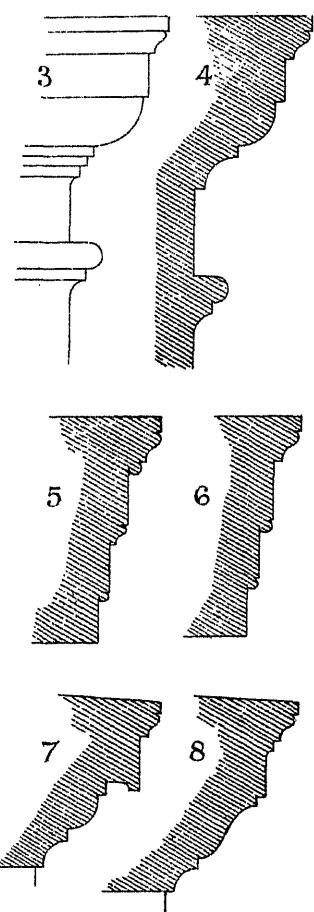
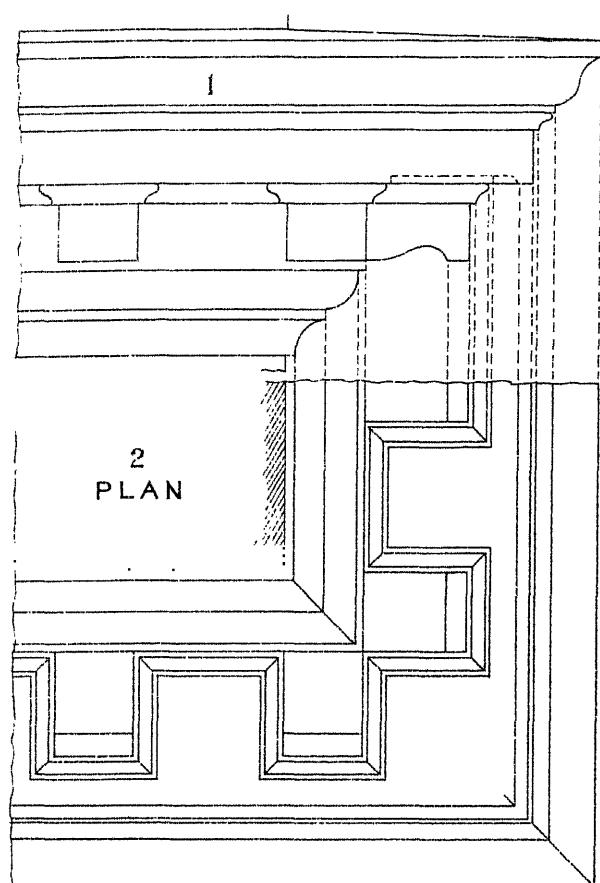
10

11

ROMAN MOULDINGS.

These mouldings are all derived from Greek originals, but without their refinement of outline, and in artistic beauty are far below their predecessors. The profiles are in most cases composed of segments of circles.

1. Elevation of Doric cornice.
2. Plan of external angle of ditto, looking up, showing the modillions.
3. Elevation of Doric cap.
4. Section of capping to Doric pedestal.
5. Section of Architrave.
6. " "
7. Section of pedestal capping.
8. " "
9. Section of Tuscan base.
10. " Doric base.
11. " Corinthian base.
12. " Composite base.
13. " pedestal plinth.
14. " "
15. Baluster (enriched).
16. "
17. "

ROMAN MOULDINGS

GLOSSARY OF TERMS.

Abacus.—The tablet or the upper member of the capital of a column ; varying in the several orders and styles.

Abutment.—The solid part of a pier which receives the thrust or lateral pressure of the arch, and from which the arch immediately springs.

Alabaster.—A white translucent species of gypsum or sulphate of lime, composed of crystalline grains in a compact mass. It is capable of being worked to a high degree of finish, and taking a fine polish.
It is much used for interior decorations, monuments, &c.

Annular Vault.—A vault springing from two walls, each circular on plan.—*See Plate XXVII.*

Annulet.—A small fillet encircling a column, used either alone or in connection with other mouldings.

Arc.—In geometry, a portion of the circumference of a circle or other curve line.

Arcade.—A covered passage composed generally of a range of arches, supported either on colums or piers, and detached from or attached to the wall.

Arch.—A concave or hollow structure supported by its own curve.

A number of wedge-shaped stones disposed in the line of some curve, and supporting each other by their mutual pressure.

The arch itself is composed of voussoirs, or arch stones, the uppermost of which is called the key-stone.—*See Plates IV. & V.*

Architrave.—The lower of the three principal members of the entablature of an order, being the chief beam resting immediately on the columns.

A collection of mouldings round a door, window, or other aperture.—*See also Entablature.*

Archivolt.—The band of mouldings round the arch stones of an arch, which terminates horizontally upon the impost.

Arris.—The line or edge on which two surfaces forming an exterior angle meet each other, either plane or curved.

Ashlar.—A term for hewn or squared stone, as distinguished from unwrought material ; it is generally used for facings, and set in horizontal courses, and bears various names according to the manner in which it is worked, such as Plain Ashlar, Tooled Ashlar, Rustic Ashlar, &c.—*See Plate X.*

Astragal.—A small moulding of a semicircular profile. The name is generally applied to the necking separating the capital from the column.—*See also Moulding.*

Axis of a Cylinder.—A right line passing through the solid, from the centre of one of the circular ends to the centre of the other, and the line on which such a body may be conceived to revolve.

Axis of a Dome.—A right line perpendicular to the horizon, passing through the centre of its base.—*See Plate XXXII.*

Banker.—A block of stone forming a bench on which the stone is worked.

Base.—In geometry, the lower part of a figure or body.

The base of a solid is the surface on which it rests.

In masonry, the lower moulded part, between the shaft and the pedestal.

Batter.—A wall that inclines inward from a vertical or plumb line, so that the upper part of the surface falls within the base.

Bed.—The horizontal surface on which a stone lies. The beds of a stone are the surfaces where the stones meet; the upper surface is called the top bed, and the under surface the bottom bed.—*See also Natural Bed.*

Billet Moulding.—A Norman moulding used in arches, strings, &c.; it consists of small short lengths of beads or bars, cut in hollow mouldings, with spaces between equal to the length of the billet.—*See Plate XLVII., Figs. 31 & 32. See also Moulding.*

Blocking-course.—A course of stones placed on the top of a cornice, forming the summit of the wall.

Boasting.—Cutting the stone roughly to form of intended carving.

Bond.—The disposition or lapping of the stones so that vertical joints may not fall over one another, but fall directly over the middle of the stone below, in order to form an inseparable mass of building.

Bond-stone.—Stones whose longest horizontal direction is placed in the thickness of the work, for the purpose of binding the wall together.

Boning.—The art of testing a plane surface by the guidance of the eye and the aid of two straight-edges, by which it is seen whether the work is out of winding, or whether the surface be plane or twisted.—*See Plate IX., Figs. 1 & 2.*

Boss.—A sculptured or carved projection to conceal the intersection of the moulded ribs in a vault, or at the stop end of a string course or label.—*See Plate XLI.*

Breaking Joint.—The placing of a stone over the course below, in such a position that the joint above shall not fall vertically directly over the joint below it.

Buttress.—A pier of masonry projecting from a wall to support and strengthen it. Buttresses are employed in Gothic buildings to resist the thrust of the vaulting and roof, and also to stiffen walls and towers of great height.

Camber.—The slightly hollowed soffit given to a lintel or flat arch to correct the apparent sinking down in the centre.

Canopy.—An ornamental projection over windows, doors, niches, &c.

Cant.—An external splay angle cut off a square.

Cantilever.—A large projecting bracket to support cornices, balconies, eaves, &c.

Capital.—The head or uppermost member of a column, pier, or pilaster, in any part of a building, but generally applied to that of a column or pilaster of the several orders.—*See CAPS*, Plates XLVII. to LII.

Chamfer.—The arris of a solid cut to a bevelled plane.

Chevron.—A zigzag or V-shaped ornament used in mouldings, chiefly to arches in Norman work.—*See Plate XLVII.*, Fig. 35.

Chiselled Work.—The surface of a stone formed by the chisel.

Chord.—In geometry, a straight line drawn from any point of an arc to any other point of that arc.

Circle.—A plane figure, of which its boundary is everywhere at an equal distance from a point within its surface, called its centre.

Its perimeter encloses the largest area of any figure.

Circular Work.—A term applied to any work with cylindric or spherical faces.

Circumference.—The curve line which bounds the area of a circle.

Circumscribe.—To draw a line round a figure so as to enclose it.

Closer.—The last stone fixed in a horizontal course which is usually of less dimensions than the others.

Coffer.—A sunk panel in vaults, domes, and arches. The name is also applied to any sunk panel in a ceiling or soffit.

Column.—A cylindrical or polygonal pier, which supports a superincumbent weight in a vertical direction ; it is generally composed of a base, shaft, and capital.—*See also Pilaster*.

Concave.—A hollow line or surface, as the soffit of an arch, vault, or the inner surface of a sphere.

Concentric.—Having the same centre but different radii.

Conic Sections.—The figures formed by the intersections of a plane with a cone, which do not include the triangle or the circle. These three sections are the ellipse, parabola, and hyperbola.

Contour.—The outline of a figure or body ; the line that bounds.

Convex.—A rising or swelling on the exterior surface into a round or spherical form, as the outside of a sphere, the extrados of an arch, &c.

Coping.—The highest and top covering course in a wall.

Corbel.—A small bracket projecting from the wall to support some superincumbent weight.

Cornice.—A horizontal projection, moulded, decorated, or otherwise, which crowns or terminates a wall, building, pedestal, or other piece of work.—*See Plate IX.*, Fig. 4.

Course.—A row of stones of the same height generally placed on a level bed. The stones round the face and intrados of an arch, are also called a course of stones.

Coursing Joint.—The joint between two courses of stone.

Crown of an Arch.—The highest or central part of an arch or any arched surface.—*See Plates IV. & V.*

Cupola.—A concave ceiling or roof, hemispherical or nearly so. A small dome.

Curtail Step.—The first or bottom step of a stairs, generally of a curved form on plan, and a curved quoin end.

Curve Line.—A concave or convex line.

Cusp.—A triangular projection from an inner curve of a tracery arch or window.
—See Plate XLVI., Fig. 10.

Cylinder.—A circular body of uniform diameter, whose ends or base form equal parallel circles, and whose curved surface is everywhere at an equal distance from its axis.

The cone, sphere, and cylinder have a relative value to each other, namely, that the cone is one-third the cylinder having the same base and height; and the inscribed sphere two-thirds of the cylinder, or the cone, sphere, and cylinder are to each other as the numbers 1, 2, 3.—See Plate IX., Fig. 3.

Cylindrical Work.—Any form of work which partakes of the shape of a cylinder.

Dentils.—The small square blocks or teeth cut in the bed mould of cornices, pediments, &c.—See Plate IX., Fig. 5.

Development.—The unrolling or laying out of a surface upon a plane, so that every point of the surface may coincide with the plane.

Diagonal.—A straight line drawn through a plane figure, joining two opposite angles.

Diameter.—A straight line passing through the centre of a curvilinear figure, and dividing the figure symmetrically into two equal parts, terminating in the circumference on each side, as that of a circle or ellipse.

Diminution of a Column.—The gradual contraction of the diameter of a column, so that the upper diameter is less than the lower.—See Plate XI., Figs. 7 & 8.

Dome.—The spherical or convex roof raised over a circular or polygonal building.

There is great variety in the forms of domes, both in plan and section.
See Plate XXXII.—See also **Cupola**.

Draft.—A margin on the surface of a stone, dressed to the width of the chisel or bolster, for the purpose of directing its reduction to the required surface.

Dressed.—A term which expresses the preparation a stone has undergone, before fixing in its position in the building.

Edge.—The meeting in an external angle of two planes or surfaces of a solid.

Elevation.—A geometrical projection drawn on a plane perpendicular to the horizon.

Ellipse or Ellipsis.—One of the conic sections, produced by cutting a cone by a plane passing obliquely through the opposite sides. It may be divided into two equal and similar parts, by a diameter drawn in any direction.

Entablature.—The superstructure which lies horizontally upon architectural columns. It consists of three portions; the architrave, which rests immediately upon the columns, the frieze or central portion, and the cornice.

Entasis.—A refined and almost imperceptible swelling of the shaft of a column.—See Plate IX., Figs. 7 & 8.

Equiangular.—Having equal angles.

Equidistant.—At equal distances.

Equilateral.—Having equal sides.

Extrados.—The exterior or convex curve of an arch.—*See* Plate IV., Fig. 1.

Face-mould.—A pattern or templet defining the form to which a stone is to be worked. It is usually made of sheet zinc.

Fillet.—A small moulding of square section. Also the space between two flutings in a column or pilaster.

Finial.—The top or finishing terminal to a gable or pinnacle.

Flush.—The bedding of masonry blocks in mortar or cement, completely filling in all interstices in the beds and joints.

The term is also used to signify the breaking off or chipping any portion of a dressed stone.

Flute.—A perpendicular hollow or channel; used to decorate the shafts of columns or pilasters.

Flyers.—Steps in a flight of stairs, whose edges are parallel to each other.—*See* Plate XII.

Foci.—The two points in the major axis of an ellipse to which a string may be fixed so as to describe the curve.

Free-stone.—A stone which can be freely worked in any direction.

Gargoyle.—A projecting waterspout usually carved into a grotesque head.

Gauge.—The measure to which any dimension is confined.

Geometry.—The science which explains, and the art which shews, the construction of lines, angles, plane figures, and solids.

Grit-stone.—A coarse or fine-grained sandstone of various degrees of hardness. It is composed of small grains of sand united by a cementing material of an argillaceous, calcareous, or siliceous nature.

Groin.—The curved line formed by the intersection of two arches or vaults crossing each other at any angle.—*See* Plate XXVII.

Groined Vault.—“One formed by three or more curved surfaces, so that every two may form a groin, all the groins terminating at one extremity in a common point.”—“Gwilt.”—*See* Plate XXXIV. and following.

Ground Line.—The straight line upon which the vertical plane of projection is placed.

Grout.—A thin semi-liquid mortar composed of cement and sand or lime and sand, and run into the joints and beds of stonework, filling all interstices.

Gypsum.—“Crystals of native sulphate of lime. Being subjected to a moderate heat, to expel the water of crystallisation, it forms plaster of Paris, and, coming in contact with water, immediately assumes a solid form. Of the numerous species, alabaster is, perhaps, the most abundant.”—“Gwilt.”

Header.—Stones extending through the thickness of a wall, as bond-stones.

Heading.—The vertical side of a stone perpendicular to the face.

Heading Joint.—The thin stratum of mortar between the vertical surfaces of two adjacent stones.

Helix.—A spiral winding round the surface of a cylinder.—*See Plate XIV.*

Hemisphere.—One half of a globe or sphere, when divided through its centre by a plane.

Hypothenuse.—The longest side of a right-angled triangle. The side opposite to the right angle.

Impost.—The capital of a pier or pilaster from which an arch springs.
Its form varies in the different orders.

Inclination.—The angle contained between a line and a plane, or between two planes.

Intersection.—The point on which two lines meet and cut each other.
The line in which two surfaces cut or meet each other.

Intrados.—The inner curve of an arch.—*See Plate IV., Fig. 1.*

Jambs.—The vertical sides of a window or door opening, which connect the two sides of a wall.

Joggle.—An indentation made in one stone, called the she joggle, to receive the projection on another termed the he joggle. *See Plate VII.*

Joint.—The surface of contact between two adjacent blocks of stone.

Jumper.—A long steel chisel used for drilling holes.—*See Plate I., Fig. 18.*

Key Course.—The horizontal range of stones in the summit of a vault, in which the course is placed.

Key Stone.—The highest central stone in the crown of an arch.—*See Plate IV., Fig. 1. See Arch.*

Label.—The drip or hood moulding over the apertures in Gothic windows and doors.

Lancet Arch.—Narrow window heads shaped like the point of a lancet, and characteristic of the Early English Gothic (13th century).

Landing.—The terminating floor of a flight of stairs, either above or below it ; or the level part of a staircase connecting one flight with another. *See Plate XII., Fig. 2.*

Level.—A line or surface horizontal or parallel to the horizon ; or a straight line perpendicular to a plumb line.

Line of Batter.—The line of section made by a plane and the surface of a battering wall, the plane being perpendicular both to the surface of the wall and to the horizon.

Lintel.—A stone which extends over the aperture of a door or window, and carries the superincumbent weight by means of its strength or resistance.

Marble.—“A term limited by mineralogists and geologists to the several varieties of carbonate of lime, having more or less of a granular and crystalline texture. It is susceptible of a very fine polish, and the varieties of it are extremely numerous.”—“Gwilt.”

Marble, Polishing of.—Marbles are of such a varied nature that one method of polishing cannot be adopted for all, although the following method will

suffice for Statuary, Vein, Sicilian, St. Anne's, and most of the ordinary coloured marbles in general use.

The wrought surface is rubbed with fine sharp sand and water, until all the marks of the chisel or saw are removed, and an even face is produced ; it is then "grounded," that is, rubbed with grit stones of varying degrees of fineness, commencing with the coarse or "first grit," next the "second grit," which is a little finer, and then finishing with "snake" or "Water of Ayr" stone. Particular care must be taken that in each process of "gritting" the marks or scratches of its predecessor are removed, so that when the surface is "snaked" no scratches whatever are visible, but left quite smooth, for upon the careful "gritting" depends the success of the ultimate polish.

The polishing is lastly effected by rubbing with a pad of felt sprinkled with putty powder (calcined tin) moistened with water, until the gloss or natural polish is obtained.

The polishing of marble adds greatly to its beauty, inasmuch as its delicate figuring, and gradations of rich colouring, are brought out and heightened by the process, which thus makes it so valuable as a decorative material.

Masonry.—The art of shaping, arranging, and uniting stones, in the construction of walls and other parts of buildings.

Metopes.—The square spaces between triglyphs in the frieze of the Doric order ; sometimes applied to the sculptures fitted into these spaces.

Modillion.—A projecting enriched bracket in the soffit of the top bed of a cornice.

Monolith.—Consisting of one stone.

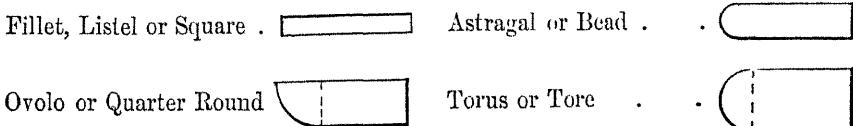
Mortise.—A sinking in a stone to receive a corresponding projection.

Mould.—A templet or pattern defining the form of the stone which is to be worked. It is usually made of sheet zinc.

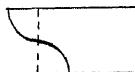
Moulding.—The outline or contour given to an angle whether a projection or a cavity.

Mouldings may be generally resolved into three elementary forms—hollow, round, and square—and it is upon the choice, arrangement, and proportion of these forms that beauty or ugliness depends. Of the two main principles in connection with mouldings, namely, projection and recession, the former is generally adopted in Classical and Renaissance architecture, and the latter in Gothic. The most perfect profiles are such as are composed of few mouldings, varied and alternating both in form and size, fitly applied with regard to their uses, and so disposed that the straight and curved members succeed each other alternately. In every profile there should be a prominent member, to which all the others should be subservient, and appear to support and fortify, or to shelter it from injury by the weather.

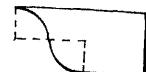
The best known examples are as follows :—



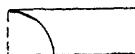
Ogee or Cyma Reversa .



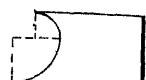
Cyma Recta or Cymatium



Cavetto or Hollow



Scotia



The above refer to mouldings of the Roman Orders.—*See also Plates XLVII. to LII.*

Mullion.—The upright post or bars of stone which subdivide a window into two or more lights. *See also Transom.*

Mural.—Belonging or attached to a wall.

Mutule.—A projecting ornament in a Doric cornice, somewhat resembling the end of a timber beam ; it occupies the place of the modillion in the other orders.

Natural Bed of a Stone.—The direction in which the natural strata lie when in the quarry.

The line of the planes of cleavage.

Newel.—The vertical column or pillar about which, in a winding stair, the steps turn, and receive support from the bottom to the top.

The newel step in an open stair is the bottom one ; it is generally curvilinear on plan.—*See Plates XII. & XIV.*

Niche.—A semicircular or hollow recess generally within the thickness of a wall, for a statue, vase, or other ornament.—*See Plates XXV. & XXVI.*

Normal.—A right line perpendicular to the tangent of a curve.

Ordinate.—“A line drawn from any part of the circumference of an ellipse or other conic section, perpendicular to, and across the axis to the other side.”—“Gwilt.”

Parabola.—One of the three conic sections.

An open curve of which both of its branches may be extended infinitely without ever meeting.

It is produced by cutting a cone by a plane parallel to one of its sides, and so named because its axis is parallel to the side of the cone.

Parallel.—Lines, surfaces, &c., that are in every part equidistant from each other, and extended in the same direction.

Pediment.—A triangular, or gabled termination to a building, sometimes also placed over doors, windows, porticoes, &c.

Perpendicular.—A line at right angles to a given line.

Pier, Pillar.—*See Column.*

Pilaster.—A square column usually attached to a wall from which it projects.

In most cases it corresponds to the columns of its order, having a similar capital, shaft, and base.

Plane.—A perfectly flat or level surface, coinciding in every direction with a straight line.

Plinth.—The base of a wall, column, &c.

Profile.—The contour outline of mouldings taken at right angles to their length.

Projection.—The art of representing any object on a plane by means of straight lines, drawn from all visible parts of those objects to intersect the plane of projection.

Quadrant.—The fourth part of a circle ; an arc of ninety degrees.

Quoins.—The courses of stone to any external angle of a building.

Radiating Joints.—Those joints which tend to a centre.—*See* Plates IV. & V.

Radius.—A right line drawn from the centre to the circumference of a circle
The semidiameter of a circle or sphere.

Raking Mouldings.—Mouldings which run in an inclined position.—*See* Plate X., Figs. 11 & 12.

Rib.—A narrow arch-formed bar projecting beyond the surface of a vault, to mark its intersection and to add strength.—*See* Plate XXXVI., Fig. 10.

Rustic Quoins.—The coursed stones to the external angles of a building, projecting beyond the face of the wall.

Sandstone.—A stone composed of grains of sand, united with other mineral substances, cemented together by a material of an argillaceous, calcareous, or siliceous nature.

Scribe.—To scratch in on the stone, with a sharp pointed tool, the profile of a mould, template, &c.

Section.—The figure formed by cutting a solid by a plane.

Segment of a Circle.—A portion of a circle contained by an arc and its chord.

Setting.—A term used to denote the fixing of dressed stones in their proper position in the walls of buildings.

Shaft.—The cylindrical part of a column between the base and the capital. *See* Plate XI., Figs. 7 & 8.

Soffit or Sofite.—The under surface of any part of a ceiling, architrave, arch, vault, stairs, &c.

Soffit Joints.—Those joints which appear on the under surface.

Span.—The distance or dimension across the opening of an arch, window, or aperture. *See* Plate IV., Fig. 1.

Spandrel.—A triangular-shaped piece. The irregular triangular space between the curve of an arch and the rectangle inclosing it ; or the space between the outer mouldings of two contiguous arches and a horizontal line above them.

Spiral.—The helix or screw.

A curve consisting of one or more revolutions round a fixed point and gradually receding from it.

Spire.—A steeple diminishing as it ascends, generally octagonal on plan.

Splay.—A slope making with the face of a wall an angle less than a right angle..

Stair.—One step of a series by means of which a person ascends or descends to a different landing.

A series of steps for passing from one part of a building to another. *See Plates XII., XIII., XIV. & XV.*

Staircase.—A flight of stairs with their supporting framework, casing, balusters, &c., which enable persons to ascend or descend from one floor to another. *See Plate XII., Fig. 2.*

Stilted Arch.—An arch in which the springing line or curve does not commence for some distance above the level of the impost.

Stone Cutting.—The art of hewing or dressing stones to their intended form.

Straight-Edge.—A rule whose edge coincides with a straight line.

Stretcher.—A stone laid with its longer face in the surface of the wall.

Tangent.—A straight line which touches a curve without cutting it.

Tangent Plane.—A plane which touches a curved surface without being able to cut it.

Templet.—A mould giving the contour to which stones are to be wrought.

Transom.—A horizontal bar across a window of two or more lights. *See also Mullion.*

Triangle.—A plane figure consisting of three sides.

Trihedral.—A solid angle consisting of three plane angles.

Trisection.—The division into three equal parts.

Tympanum.—The triangular face of a pediment included between the horizontal and raking mouldings.

Vault.—An arched roof or ceiling over an apartment, so constructed that the stones of which it is composed sustain and keep each other in their places. *See Plates XXVII. to XXIX. & XXXIV. to XLI.*

Vertical Plane.—A plane perpendicular to the horizon.

Volute.—A spiral scroll as in the Ionic capital.

Voussoir.—A wedge-shaped stone forming one of the blocks of an arch. *See Plate IV., Fig. 1.*

Weathering.—A sloping surface of stone employed to cover the set-off of a wall or buttress, and protect it from the effects of the weather.

Welch Groin.—A groin formed by the intersection of two cylindrical vaults, one being of greater height than the other.

Winder.—One in a flight of steps which are curved on plan, having each tread broader at one end than the other. *See Plates XIII. & XIV.*

Wreathed Column.—Twisted in the form of a screw or spiral.

CROSBY LOCKWOOD & SON'S

Catalogue of

SCIENTIFIC, TECHNICAL AND INDUSTRIAL BOOKS.

	PAGE		PAGE
Mechanical Engineering	1	Carpentry and Timber	28
Civil Engineering	10	Decorative Arts	30
Marine Engineering, &c.	17	Natural Science	32
Mining and Metallurgy	19	Chemical Manufactures	34
Colliery Working, &c.	21	Industrial Arts	36
Electricity	23	Commerce, Tables, &c.	41
Architecture and Building	25	Agriculture and Gardening	43
Sanitation and Water Supply	27	Auctioneering, Valuing, &c..	46
Law and Miscellaneous	47		

MECHANICAL ENGINEERING, ETC.

THE MECHANICAL ENGINEER'S POCKET-BOOK.

Comprising Tables, Formulae, Rules, and Data: A Handy Book of Reference for Daily Use in Engineering Practice. By D. KINNEAR CLARK, M. Inst. C.E. Fourth Edition. Small 8vo, 700 pages, bound in flexible leather cover, rounded corners

6/-

SUMMARY OF CONTENTS.

MATHEMATICAL TABLES.—MEASUREMENT OF SURFACES AND SOLIDS.—ENGLISH WEIGHTS AND MEASURES.—FRENCH METRIC WEIGHTS AND MEASURES.—FOREIGN WEIGHTS AND MEASURES.—MONEYS.—SPECIFIC GRAVITY, WEIGHT AND VOLUME.—MANUFACTURED METALS.—STEEL PIPES.—BOLTS AND NUTS.—SUNDY ARTICLES IN WROUGHT AND CAST IRON, COPPER, BRASS, LEAD, TIN, ZINC.—STRENGTH OF MATERIALS.—STRENGTH OF TIMBER.—STRENGTH OF CAST IRON.—STRENGTH OF WROUGHT IRON.—STRENGTH OF STEEL.—TENSILE STRENGTH OF COPPER, LEAD, ETC.—RESISTANCE OF STONES AND OTHER BUILDING MATERIALS.—RIVETED JOINTS IN BOILER PLATES.—BOILER SHELLS.—WIRE ROSES AND HEMP ROSES.—CHAINS AND CHAIN CABLES.—FRAMING.—HARDNESS OF METALS, ALLOYS AND STONES.—LABOUR OF ANIMALS.—MECHANICAL PRINCIPLES.—GRAVITY AND FALL OF BODIES. ACCELERATING AND RETARDING FORCES.—MILL GEARING, SHAFTING, &c.—TRANSMISSION OF MOTIVE POWER. HEAT.—COMBUSTION: FUELS.—WARMING, VENTILATION, COOKING STOVES.—STRAM, STEAM ENGINES AND BOILERS.—RAILWAYS.—TRAMWAYS.—STEAM SHIPS.—PUMPING STEAM ENGINES AND PUMPS.—COAL GAS, GAS ENGINES, &c.—AIR IN MOTION.—COMPRESSED AIR.—HOT AIR ENGINES.—WATER POWER.—SPEED OF CUTTING TOOLS.—COLOURS.—ELECTRICAL ENGINEERING.

"Mr. Clark manifests what is an innate perception of what is likely to be useful in a pocket book, and he is really unequalled in the art of condensation. It is very difficult to hit upon any mechanical engineering subject concerning which this work supplies no information, and the excellent index at the end adds to its utility. In one word, it is an exceedingly handy and efficient tool, possessed of which the engineer will be saved many a wearisome consultation, or yet more wearisome hunt through various text-books and treatises, and, as such, we can heartily recommend it to our readers."—*The Engineer*.

"It would be found difficult to compress more matter within a similar compass or produce a book of 700 pages which should be more compact or convenient for pocket reference. . . . Will be appreciated by mechanical engineers of all classes."—*Practical Engineer*.

MR. HUTTON'S PRACTICAL HANDBOOKS.

THE WORKS MANAGER'S HANDBOOK.

Comprising Modern Rules, Tables, and Data. For Engineers, Millwrights, and Boiler Makers; Tool Makers, Machinists, and Metal Workers; Iron and Brass Founders, &c. By W. S. HUTTON, Civil and Mechanical Engineer, Author of "The Practical Engineer's Handbook." Sixth Edition, carefully Revised and enlarged. In One handsome Volume, medium 8vo, strongly bound.

[Just Published. 15/-]

"The Author having compiled Rules and Data for his own use in a great variety of modern engineering work, and having found his notes extremely useful, decided to publish them—revised to date—believing that a practical work, suited to the DAILY REQUIREMENTS OF MODERN ENGINEERS, would be favourably received."

"Of this edition we may repeat the appreciative remarks we made upon the first and third. Since the appearance of the latter very considerable modifications have been made, although the total number of pages is nearly the same. It is a very useful collection of rules, tables, and workshop and shop practice, rather than from the theoretical or literary aspect. The volume contains much that kind of information which is gained only by practical experience, and is well worth the price."—*The Engineer*, May 10, 1895.

"The author treats every subject from the point of view of one who has collected workshop notes and practical data from his own experience in workshop practice, rather than from the theoretical or literary aspect. The volume contains much that kind of information which is gained only by practical experience, and is well worth the price."—*The Engineer*, June 5, 1885.

"The volume is an exceedingly useful one, brimful with engineer's notes, memoranda, and rules, and well worthy of being on every mechanical engineer's bookshelf."—*Mechanical World*.

"The information is precisely that likely to be required in practice. . . . The work forms a desirable addition to the library not only of the works' manager, but of any one connected with general engineering."—*Mining Journal*.

"Brimful of useful information, stated in a concise form, Mr. Hutton's books have met a pressing want among engineers. The book must prove extremely useful to every practical man possessing a copy."—*Practical Engineer*.

THE PRACTICAL ENGINEER'S HANDBOOK.

Comprising a Treatise on Modern Engines and Boilers, Marine, Locomotive, and Stationary. And containing a large collection of Rules and Practical Data relating to recent Practice in Designing and Constructing all kinds of Engines, Boilers, and other Engineering work. The whole constituting a comprehensive Key to the Board of Trade and other Examinations for Certificates of Competency in Modern Mechanical Engineering. By WALTER S. HUTTON, Civil and Mechanical Engineer, Author of "The Works' Manager's Handbook for Engineers," &c. With upwards of 370 Illustrations. Fifth Edition, Revised, with Additions. Medium 8vo, nearly 500 pp., strongly bound. 18/-

"This work is designed as a companion to the Author's 'WORKS MANAGER'S HANDBOOK.' It possesses many new and original features, and contains, like its predecessor, a quantity of matter not originally intended for publication, but collected by the Author for his own use in the construction of a great variety of MODERN ENGINEERING WORK."

"The information is given in a condensed and concise form, and is illustrated by upwards of 370 Woodcuts; and comprises a quantity of tabulated matter of great value to all engaged in designing, constructing, or estimating for ENGINES, BOILERS, and OTHER ENGINEERING WORK."

"We have kept it at hand for several weeks, referring to it as occasion arose, and we have not on a single occasion consulted its pages without finding the information of which we were in quest."—Athenaeum.

"A thoroughly good practical handbook, which no engineer can go through without learning something that will be of service to him."—Marine Engineer.

"An excellent book of reference for engineers, and a valuable text-book for students of engineering."—Scotsman.

"This valuable manual embodies the results and experience of the leading authorities on mechanical engineering."—Building News.

"The author has collected together a surprising quantity of rules and practical data, and has shown much judgment in the selections he has made. . . . There is no doubt that this book is one of the most useful of its kind published, and will be a very popular compendium."—Engineer.

"A mass of information, set down in simple language, and in such a form that it can be easily referred to at any time. The matter is uniformly good and well chosen, and is greatly facilitated by the illustrations. The book will find its way on to most engineers' shelves, where it will rank as one of the most useful books of reference."—Practical Engineer.

"Full of useful information, and should be found on the office shelf of all practical engineers."—English Mechanic.

MR. HUTTON'S PRACTICAL HANDBOOKS—continued.

STEAM BOILER CONSTRUCTION.

A Practical Handbook for Engineers, Boiler-Makers, and Steam Users. Containing a large Collection of Rules and Data relating to Recent Practice in the Design, Construction, and Working of all kinds of Stationary, Locomotive, and Marine Steam-Boilers. By WALTER S. HUTTON, Civil and Mechanical Engineer, Author of "The Works Manager's Handbook," "The Practical Engineer's Handbook," &c. With upwards of 500 Illustrations. Third Edition, thoroughly Revised, in part Re-written, and much Enlarged. Medium 8vo, over 600 pages, cloth, strongly bound. **18/-**

NOTE THIS WORK IS ISSUED IN continuation of the Series of Handbooks written by the Author, viz.:—"THE WORKS MANAGER'S HANDBOOK" and "THE PRACTICAL ENGINEER'S HANDBOOK," which are so highly appreciated by Engineers for the practical nature of their information; and is consequently written in the same style as those works.

The Author believes that the concentration, in a convenient form for easy reference, of such a large amount of thoroughly practical information on Steam-Boilers, will be of considerable service to those for whom it is intended, and he trusts the book may be deemed worthy of as favourable a reception as has been accorded to its predecessors.

"One of the best, if not the best, books on boilers that has ever been published. The information is of the right kind, in a simple and accessible form. So far as generation is concerned, this is, undoubtedly, the standard book on steam practice."—*Electrical Review*.

"Every detail, both in boiler design and management, is clearly laid before the reader. The volume shows that boiler construction has been reduced to the condition of one of the most exact sciences; and such a book is of the utmost value to the *fin de siècle* Engineer and Works Manager."—*Marine Engineer*.

"There has long been room for a modern handbook on steam boilers; there is not that room now, because Mr. Hutton has filled it. It is a thoroughly practical book for those who are occupied in the construction, design, selection, or use of boilers."—*Engineer*.

"The book is of so important and comprehensive a character that it must find its way into the libraries of every one interested in boiler using or boiler manufacture if they wish to be thoroughly informed. We strongly recommend the book for the intrinsic value of its contents."—*Machinery Market*.

PRACTICAL MECHANICS' WORKSHOP COMPANION.

Comprising a great variety of the most useful Rules and Formulae in Mechanical Science, with numerous Tables of Practical Data and Calculated Results for Facilitating Mechanical Operations. By WILLIAM TEMPLETON, Author of "The Engineer's Practical Assistant," &c., &c. Eighteenth Edition, Revised, Modernised, and considerably Enlarged, by WALTER S. HUTTON, C.E., Author of "The Works Manager's Handbook," "The Practical Engineer's Handbook," &c. Fcap. 8vo, nearly 500 pp., with 8 Plates and upwards of 250 Illustrative Diagrams, strongly bound for workshop or pocket wear and tear. **[Just Published. 6/-]**

"In its modernised form Hutton's 'Templeton' should have a wide sale, for it contains much valuable information which the mechanic will often find of use, and not a few tables and notes which he might look for in vain in other works. This modernised edition will be appreciated by all who have learned to value the original editions of 'Templeton'."—*English Mechanic*.

"It has met with great success in the engineering workshop, as we can testify; and there are a great many men who, in a great measure, owe their rise to 'it': to this little book."—*Building News*.

"This familiar hand-book—well known, to all mechanics and engineers—is of essential service to the every-day requirements of engineers, millwrights, and the various trades connected with engineering and building. The new modernised edition is worth its weight in gold."—*Building News*. (Second Notice.)

"This well-known and largely-used book contains information, brought up to date, of the sort so useful to the foreman and draughtsman. So much fresh information has been introduced as to constitute it practically a new book. It will be largely used in the office and workshop."—*Mechanical World*.

"The publishers wisely entrusted the task of revision of this popular, valuable, and useful book to Mr. Hutton, than whom a more competent man they could not have found."—*Iron*.

ENGINEER'S AND MILLWRIGHT'S ASSISTANT.

A collection of Useful Tables, Rules, and Data. By WILLIAM TEMPLETON. Eighth Edition, with Additions. 18mo, cloth. **2/6**

"Occupies a foremost place among books of this kind. A more suitable present to an apprentice to any of the mechanical trades could not possibly be made."—*Building News*.

"A deservedly popular work. It should be in the 'drawer' of every mechanician."—*English Mechanic*.

THE MECHANICAL ENGINEER'S REFERENCE BOOK.

For Machine and Boiler Construction. In Two Parts. Part I. GENERAL
ENGINEERING DATA. Part II. BOILER CONSTRUCTION. With 51 Plates and
numerous Illustrations. By NELSON FOLEY, M.I.N.A. Second Edition, Revised
throughout and much Enlarged. Folio, half-bound . . . Net. £3 3s.

PART I. MEASURES.—CIRCUMFERENCES AND AREAS, &c., SQUARES, CUBES, FOURTH POWERS.—
SQUARE AND CUBE ROOTS.—SURFACE OF TUBES.—RECIPROCALS.—LOGARITHMS.—MENSURATION.—
SPECIFIC GRAVITIES AND WEIGHTS.—WORK AND POWER.—HEAT.—COMBUSTION.—EXPANSION AND
CONTRACTION.—EXPANSION OF GASES.—STEAM.—STATIC FORCES.—GRAVITATION AND ATTRACTION.—
—MOTION AND COMPUTATION OF RESULTING FORCES.—ACCUMULATED WORK.—CENTRE AND RADIUS
OF GYRATION.—MOMENT OF INERTIA.—CENTRE OF OSCILLATION.—ELECTRICITY.—STRENGTH OF
MATERIALS.—ELASTICITY.—TEST SHEETS OF METALS.—FRICTION.—TRANSMISSION OF POWER.—
FLOW OF LIQUIDS. FLOW OF GASES.—AIR PUMPS, SURFACE CONDENSERS, &c.—SPRAYS OF STEAM.—
SPHERES.—TRIANGLES.—CALTING TOOLS.—FLANGES.—COPPER SHEETS AND TUBES.—SCREWS, NUTS,
BOLT HEADS, &c.—RIVETS AND MISCELLANEOUS MATTER.—WITH DIAGRAMS FOR VALVE-GEAR,
BELTING AND ROPES, DISCHARGE AND SUCTION PIPES, SCREW PROPELLERS AND COPPER PIPES.

PART II. TREATING OF POWER OF BOILERS.—USEFUL RATIOS.—NOTES ON CONSTRUCTION.—CYLINDRICAL BOILER SHELLS.—CIRCULAR FURNACES.—FLAT PLATES.—STAYS.—GIRDERS.—SCREWS.—HYDRAULIC TESTS.—RIVETING.—BOILER SETTING, CHIMNEYS, AND MOUNTINGS.—FUELS, &c.—EXAMPLES OF BOILERS AND SPEEDS OF STEAMSHIPS.—NOMINAL AND NORMAL HORSE POWER.—WITH DIAGRAMS FOR ALL BOILER CALCULATIONS AND DRAWINGS OF MANY VARIETIES OF BOILERS.

"Mr. Foley is well fitted to compile such a work. It may be stated that Mr. Foley has produced a volume which will meet the desire of the author and become indispensable to all mechanical engineers. We have carefully examined this excellent reference book for the

"We have carefully examined this excellent reference book for the use of marine engineers."—*Journal of*

COAL AND SPEED TABLES.

A Pocket-book for Engineers and Steam-users. By NELSON FOLEY, Author of
"The Mechanical Engineer's Reference Book." Pocket-size, cloth . 3/6

"These tables are designed to meet the requirements of every-day use; they are of sufficient scope for most practical purposes, and may be commended to engineers and users of steam."—Iron.

TEXT-BOOK ON THE STEAM ENGINE.

With a Supplement on GAS ENGINES, and PART II. on HEAT ENGINES. By T. M. GOODEVE, M.A., Barrister-at-Law, Professor of Mechanics at the Royal College of Science, London; Author of "The Principles of Mechanics," "The Elements of Mechanism," &c. Fourteenth Edition. Crown 8vo. cloth £6.

Mr. Goodwin's text-book is a work of great value, and every student of mining should possess himself."—*Mining Journal.*

ON GAS ENGINES.

With Appendix describing a Recent Engine with Tube Igniter. By T. M.
GOODEVE, M.A. Crown 8vo, cloth **2/6**

"Like all Mr. Goodeve's writings, the present is no exception in point of general excellence. It is a valuable little volume."—*Mechanical World*.

THE GAS ENGINE HANDBOOK.

A Manual of Useful Information for the Designer and the Engineer. By E. W. ROBERTS, M.E. With 40 full-page Engravings. Small Fcap. 8vo. Just Published. Net. 8/6

TREATISE ON STEAM BOILERS.

THE MECHANICAL ENGINEER'S COMPANION.

Of Areas, Circumferences, Decimal Equivalents, in inches and feet, millimetres, squares, cubes, roots, &c.; Strength of Bolts, Weight of Iron, &c.; Weights, Measures, and other Data. Also Practical Rules for Engine Proportions. By R. EDWARDS, M.Inst.C.E. Fcap. 8vo, cloth. [Just Published. 3/-]

"A very useful little volume, useful to engineers." —*Engineer.* It contains many tables, classified data and memoranda, generally

"What it professes to be, 'a handy office companion,' giving, in a succinct form, a variety of information likely to be required by mechanical engineers in their everyday office work."—*Nature*.

A HANDBOOK ON THE STEAM ENGINE.

With especial Reference to Small and Medium-sized Engines. For the Use of Engine Makers, Mechanical Draughtsmen, Engineering Students, and Users of Steam Power. By HERMAN HAEDER, C.E. Translated from the German with Additions and Alterations, by H. H. P. POWLES, A.M.I.C.E., M.I.M.E. Second Edition, Revised. With nearly 1,100 Illustrations. Crown 8vo, cloth. 9/-

"A perfect encyclopaedia of the steam engine and its details, and one which must take a permanent place in English drawing-offices and workshops."—*A Foreman Pattern-maker.*

"This is an excellent book, and should be in the hands of all who are interested in the construction and design of medium-sized stationary engines. . . . A careful study of its contents and the arrangement of the sections leads to the conclusion that there is probably no other book like it in this country. The volume aims at showing the results of practical experience, and it certainly may claim a complete achievement of this idea."—*Nature.*

"There can be no question as to its value. We cordially commend it to all concerned in the design and construction of the steam engine."—*Mechanical World.*

BOILER AND FACTORY CHIMNEYS.

Their Draught-Power and Stability. With a Chapter on *Lightning Conductors*, By ROBERT WILSON, A.I.C.E., Author of "A Treatise on Steam Boilers," &c. Crown 8vo, cloth 3/6

"A valuable contribution to the literature of scientific building."—*The Builder.*

BOILER-MAKER'S READY RECKONER & ASSISTANT.

With Examples of Practical Geometry and Templatting, for the Use of Platers, Smiths, and Riveters. By JOHN COURNEY, Edited by D. K. CLARK, M.I.C.E. Third Edition, 480 pp., with 140 Illustrations. Fcap. 8vo, half-bound 7/-

"No workman or apprentice should be without this book."—*Iron Trade Circular.*

REFRIGERATING & ICE-MAKING MACHINERY.

A Descriptive Treatise for the Use of Persons Employing Refrigerating and Ice-Making Installations, and others. By A. J. WALLIS-TAYLER, Assoc. Member Inst. C.E. Second Edition, Revised and Enlarged. Crown 8vo, cloth. 7/6

"Practical, explicit and profusely illustrated."—*Glasgow Herald.*

"We recommend the book, which gives an account of various systems and illustrations showing details of parts of machinery and general arrangements of large ice installations."—*Builder.*

"May be recommended as a useful compilation of the machinery, the processes, and of the facts, figures, and tabulated physics of refrigerating. It is one of the best compilations on the subject."—*Engineer.*

TEA MACHINERY AND TEA FACTORIES.

A Descriptive Treatise on the Mechanical Appliances required in the Cultivation of the Tea Plant and the Preparation of Tea for the Market. By A. J. WALLIS-TAYLER, A.M.Inst.C.E. Medium 8vo, 468 pp. With 218 Illustrations.

[Just Published. Net 25/-]

SUMMARY OF CONTENTS.

MECHANICAL CULTIVATION OR TILLAGE OF THE SOIL.—PLUCKING OR GATHERING THE LEAF.—TEA FACTORIES.—THE DRESSING, MANUFACTURE OR PREPARATION OF TEA BY MECHANICAL MEANS.—ARTIFICIAL WITHERING OF THE LEAF.—MACHINES FOR ROLLING OR CURLING THE LEAF.—FERMENTING PROCESS.—MACHINES FOR THE AUTOMATIC DRYING OR FIRING OF THE LEAF.—MACHINES FOR NON-AUTOMATIC DRYING OR FIRING OF THE LEAF.—DRYING OR FIRING MACHINES.—BREAKING OR CUTTING, AND SORTING MACHINES.—PACKING THE TEA.—MEANS OF TRANSPORT ON TEA PLANTATIONS.—MISCELLANEOUS MACHINERY AND APPARATUS.—FINAL TREATMENT OF THE TEA.—TABLES AND MEMORANDA.

"When tea planting was first introduced into the British possessions, little, if any, machinery was employed, but now its use is almost universal. This volume contains a very full account of the machinery necessary for the proper outfit of a factory, and also a description of the processes best carried out by this machinery."—*Journal Society of Arts.*

ENGINEERING ESTIMATES, COSTS, & ACCOUNTS.

A Guide to Commercial Engineering. With numerous Examples of Estimates and Costs of Millwright Work, Miscellaneous Productions, Steam Engines and Steam Boilers; and a Section on the Preparation of Costs Accounts. By A GENERAL MANAGER. Second Edition. 8vo, cloth. [Just Published. 12/-]

"This is an excellent and very useful book, covering subject-matter in constant requisition in every factory and workshop. . . . The book is invaluable, not only to the young engineer, but also to the estimateman of every works."—*Builder.*

"We accord the work unqualified praise. The information is given in a plain, straightforward manner, and bears throughout evidence of the intimate practical acquaintance of the author with every phase of commercial engineering."—*Mechanical World.*

AERIAL OR WIRE-ROPE TRAMWAYS.

Their Construction and Management. By A. J. WALLIS-TAYLER, A.M.Inst.C.E. With 81 Illustrations. Crown 8vo, cloth. [Just Published. 7/-

"This is in its way an excellent volume. Without going into the minutiae of the subject, it yet lays before its readers a very good exposition of the various systems of rope transmission in use, and gives as well not a little valuable information about their working, repair, and management. We can safely recommend it as a useful general treatise on the subject."—*The Engineer*.

"The book will rank with the best on this useful topic, and we recommend it to those whose business is the transporting of minerals and goods."—*Mining Journal*.

MOTOR CARS OR POWER CARRIAGES FOR COMMON ROADS.

By A. J. WALLIS-TAYLER, A.M.Inst.C.E. Author of "Modern Cycles," &c. 212 pp., with 76 Illustrations. Crown 8vo, cloth. 4/-

"The book is clearly expressed throughout, and is just the sort of work that an engineer, thinking of turning his attention to motor-carriage work, would do well to read as a preliminary to starting operations."—*Engineering*.

PLATING AND BOILER MAKING.

A Practical Handbook for Workshop Operations. By JOSEPH G. HORNER, A.M.I.M.E. 380 pp., with 338 Illustrations. Crown 8vo, cloth. 7/-

"This work is characterised by that evidence of close acquaintance with workshop methods which will render the book exceedingly acceptable to the practical hand. We have no hesitation in commending the work as a serviceable and practical handbook on a subject which has not hitherto received much attention from those qualified to deal with it in a satisfactory manner."—*Mechanical World*.

PATTERN MAKING.

A Practical Treatise, embracing the Main Types of Engineering Construction, and including Gearing, both Hand and Machine-made, Engine Work, Sheaves and Pulleys, Pipes and Columns, Screws, Machine Parts, Pumps and Cocks, the Moulding of Patterns in Loam and Greensand, &c., together with the methods of Estimating the weight of Castings; with an Appendix of Tables for Workshop Reference. By JOSEPH G. HORNER, A.M.I.M.E. Second Edition, Enlarged. With 450 Illustrations. Crown 8vo, cloth. 7/-

"A well-written technical guide, evidently written by a man who understands and has practised what he has written about. . . . We cordially recommend it to engineering students, young journeymen, and others desirous of being initiated into the mysteries of pattern-making."—*Builder*.

"An excellent *vade mecum* for the apprentice who desires to become master of his trade."—*English Mechanic*.

MECHANICAL ENGINEERING TERMS.

(Lockwood's Dictionary of). Embracing those current in the Drawing Office, Pattern Shop, Foundry, Fitting, Turning, Smiths', and Boiler Shops, &c., &c. Comprising upwards of 6,000 Definitions. Edited by JOSEPH G. HORNER, A.M.I.M.E. Second Edition, Revised, with Additions. Crown 8vo, cloth. 7/-

"Just the sort of handy dictionary required by the various trades engaged in mechanical engineering. The practical engineering pupil will find the book of great value in his studies, and every mechanician and mechanic should have a copy."—*Building News*.

TOOTHED GEARING.

A Practical Handbook for Offices and Workshops. By J. HORNER, A.M.I.M.E. With 184 Illustrations. Crown 8vo, cloth. 6/-

"We give the book our unqualified praise for its thoroughness of treatment and recommend it to all interested as the most practical book on the subject yet written."—*Mechanical World*.

FIRE PROTECTION.

A Complete Manual of the Organisation, Machinery, Discipline and General Working of the Fire Brigade of London. By CAPTAIN EVRE M. SHAW, C.B., Chief Officer, Metropolitan Fire Brigade. New and Revised Edition. Demy 8vo, cloth. Net 5/-

FIRES, FIRE-ENGINES, AND FIRE-BRIGADES.

With a History of Fire-Engines, their Construction, Use, and Management; Foreign Fire Systems; Hints on Fire-Brigades, &c. By C. F. T. YOUNG, C.E. 8vo, cloth. 24/-

"To such of our readers as are interested in the subject of fires and fire apparatus, we can most heartily commend this book."—*Engineering*.

STONE-WORKING MACHINERY.

A Manual dealing with the Rapid and Economical Conversion of Stone. With Hints on the Arrangement and Management of Stone Works. By M. Powis BALE, M.I.M.E. Second Edition, Enlarged. With Illustrations. Crown 8vo, cloth. [Just Published. 9/-]
 "The book should be in the hands of every mason or student of stonework."—*Colliery Guardian*.
 "A capital handbook for all who manipulate stone for building or ornamental purposes."—*Machinery Market*.

PUMPS AND PUMPING.

A Handbook for Pump Users. Being Notes on Selection, Construction, and Management. By M. Powis BALE, M.I.M.E. Fourth Edition. Crown 8vo, cloth. [Just Published. 3/6]

"The matter is set forth as concisely as possible. In fact, condensation rather than diffuseness has been the author's aim throughout; yet he does not seem to have omitted anything likely to be of use."—*Journal of Gas Lighting*.
 "Thoroughly practical and simply and clearly written."—*Glasgow Herald*.

MILLING MACHINES AND PROCESSES.

A Practical Treatise on Shaping Metals by Rotary Cutters. Including Information on Making and Grinding the Cutters. By PAUL N. HASLUCK, Author of "Lathe Work." With upwards of 300 Engravings. Large crown 8vo, 352 pages, cloth. 12/6

"A new departure in engineering literature. . . . We can recommend this work to all interested in milling machines; it is what it professes to be—a practical treatise."—*Engineer*.
 "A capital and reliable book which will no doubt be of considerable service both to those who are already acquainted with the process as well as to those who contemplate its adoption."—*Industries*.

LATHE-WORK.

A Practical Treatise on the Tools, Appliances, and Processes employed in the Art of Turning. By PAUL N. HASLUCK. Sixth Edition. Crown 8vo, cloth. 5/-

"Written by a man who knows not only how work ought to be done, but who also knows how to do it, and how to convey his knowledge to others. To all turners this book would be valuable."—*Engineering*.

"We can safely recommend the work to young engineers. To the amateur it will simply be invaluable. To the student it will convey a great deal of useful information."—*Engineer*.

SCREW THREADS.

And Methods of Producing Them. With numerous Tables and complete Directions for using Screw-Cutting Lathes. By PAUL N. HASLUCK, Author of "Lathe-Work," &c. With Seventy-four Illustrations. Fifth Edition. Waistcoat-pocket size. 1/6

"Full of useful information, hints, and practical criticism. Taps, dies, and screwing tools generally are illustrated and their uses described."—*Mechanical World*.
 "It is a complete compendium of all the details of the screw-cutting lathe; in fact a *multum-in-parvo* on all the subjects it treats upon."—*Carpenter and Builder*.

TABLES AND MEMORANDA FOR ENGINEERS, MECHANICS, ARCHITECTS, BUILDERS, &c.

Selected and Arranged by FRANCIS SMITH. Sixth Edition, Revised, including ELECTRICAL TABLES, FORMULÆ, AND MEMORANDA. Waistcoat-pocket size, limp leather. [Just Published. 1/6]

"It would, perhaps, be as difficult to make a small pocket-book selection of notes and formulæ to suit all engineers as it would be to make a universal medicine; but Mr. Smith's waistcoat-pocket collection may be looked upon as a successful attempt."—*Engineer*.

"The best example we have ever seen of 700 pages of useful matter packed into the dimensions of a card case."—*Building News*. "A veritable pocket treasury of knowledge."—*Iron*.

POCKET GLOSSARY OF TECHNICAL TERMS.

English-French, French-English; with Tables suitable for the Architectural, Engineering, Manufacturing, and Nautical Professions. By JOHN JAMES FLETCHER, Engineer and Surveyor. Third Edition. 200 pp. Waistcoat-pocket size, limp leather. [Just Published. 1/6]

"It is a very great advantage for readers and correspondents in France and England to have so large a number of the words relating to engineering and manufactures collected in a filiputian volume. The little book will be useful both to students and travellers."—*Architect*.

"The glossary of terms is very complete, and many of the Tables are new and well-arranged. We cordially commend the book."—*Mechanical World*.

THE ENGINEER'S YEAR-BOOK FOR 1901.

Comprising Formulae, Rules, Tables, Data and Memoranda in Civil, Mechanical, Electrical, Marine and Mine Engineering. By H. R. KEMPE, A.M.Inst.C.E., M.I.E.E., Technical Officer of the Engineer-in-Chief's Office, General Post Office, London, Author of "A Handbook of Electrical Testing," "The Electrical Engineer's Pocket-Book," &c. With nearly 1,000 Illustrations, specially Engraved for the work. Crown 8vo, 850 pages, leather. [Just Published. **8/-**

"Represents an enormous quantity of work, and forms a desirable book of reference."—*The Engineer*.

"The importance of most similar publications in this country."—*Engineering*.

"This book of reference meets the demands of all descriptions of engineers."

"Teems with up-to-date information in every branch of engineering and construction."—*Building News*.

"The needs of the engineering profession could hardly be supplied in a more admirable, completest and convenient form. To say that it more than sustains all comparisons is praise of the highest sort, and that may justly be said of it."—*Mining Journal*.

"There is certainly room for the new comer, which supplies explanations and directions, as well as formulae and tables. It deserves to become one of the most successful of the technical annuals."—*Architect*.

"Brings together with great skill all the technical information which an engineer has to use day by day. It is in every way admirably to prove successful."—*Scotsman*.

"The up-to-dateness of Mr. is a quality that will not be lost on the busy people for whom the work is intended."—*Glasgow Herald*.

THE PORTABLE ENGINE.

A Practical Manual on its Construction and Management. For the Use of Owners and Users of Steam Engines generally. By WILLIAM DYSON WANSBROUGH. Crown 8vo, cloth. **3/6**

"This is a work of value to those who use steam machinery. . . . Should be read by every one who has a steam engine, on a farm or elsewhere."—*Mark Lane Express*.

"We cordially commend this work to buyers and owners of steam engines, and to those who have to do with their construction or use."—*Timber Trades Journal*.

"Such a general knowledge of the steam-engine as Mr. Wansbrough furnishes to the reader should be acquired by all intelligent owners and others who use the steam engine."—*Building News*.

"An excellent text-book of this useful form of engine. The 'Hints to Purchasers' contain a good deal of common-sense and practical wisdom."—*English Mechanic*.

IRON AND STEEL.

A work for the Forge, Foundry, Factory, and Office. Containing ready, useful, and trustworthy Information for Ironmasters and their Stock-takers; Managers of Bar, Rail, Plate, and Sheet Rolling Mills; Iron and Metal Founders; Iron Ship and Bridge Builders; Mechanical, Mining, and Consulting Engineers; Architects, Contractors, Builders, &c. By CHARLES HOARE, Author of "The Slide Rule," &c. Ninth Edition. 32mo, leather. **6/-**

"For comprehensiveness the book has not its equal."—*Iron*.

"One of the best of the pocket books."—*English Mechanic*.

CONDENSED MECHANICS.

A Selection of Formulae, Rules, Tables, and Data for the Use of Engineering Students, Science Classes, &c. In accordance with the Requirements of the Science and Art Department. By W. G. CRAWFORD HUGHES, A.M.I.C.E. Crown 8vo, cloth. **2/6**

"The book is well fitted for those who are either confronted with practical problems in their work, or are preparing for examination and wish to refresh their knowledge by going through their formulæ again."—*Marine Engineer*.

"It is well arranged, and meets the wants of those for whom it is intended."—*Railway News*.

THE SAFE USE OF STEAM.

Containing Rules for Unprofessional Steam-users. By an ENGINEER. Seventh Edition. Sewed. **6d.**

"If steam-users would but learn this little book by heart, boiler explosions would become sensations by their rarity."—*English Mechanic*.

THE LOCOMOTIVE ENGINE.

The ^{1st} Locomotive Engine. By ROBERT WEATHERBURN, M.I. and Portraits of GEORGE and ROBERT STEPHENSON. Crown 8vo, cloth. [Just Published. Net. 2/6]
 WHEELS.—PUMPS, CLACKS, &c.—INJECTORS.—BOILERS.—SMOKE BOX.—CHIMNEY.—WEATHER BOARD AND AWNING.—INTERNAL DISSENSIONS.—ENGINE DRIVERS, &c.
 "It would be difficult to imagine anything more ingeniously planned, more cleverly worked out, and more charmingly written. Readers, whether young or old, of a mechanical turn, cannot fail to find the volume most enjoyable as well as most instructive."—*Glasgow Herald*.

THE LOCOMOTIVE ENGINE & ITS DEVELOPMENT.

A Popular Treatise on the Gradual Improvements made in Railway Engines between 1803 and 1896. By CLEMENT E. STRETTON, C.E. Fifth Edition, Revised and Enlarged. With 120 Illustrations. Crown 8vo, cloth 3/6
 "Students of railway history and all who are interested in the evolution of the modern locomotive will find much to attract and entertain in this volume."—*The Times*.

LOCOMOTIVE ENGINE DRIVING.

A Practical Manual for Engineers in Charge of Locomotive Engines. By MICHAEL REYNOLDS, formerly Locomotive Inspector, L. B. and S. C. R. Ninth Edition. Including a KEY TO THE LOCOMOTIVE ENGINE. Cr. 8vo, cloth. 4/6
 "Mr. Reynolds has supplied a want, and has supplied it well. We can confidently recommend the book not only to the practical driver, but to everyone who takes an interest in the performance of locomotive engines."—*The Engineer*.
 "Mr. Reynolds has opened a new chapter in the literature of the day. This admirable practical treatise, of the practical utility of which we have to speak in terms of warm commendation."—*Athenaeum*.

THE MODEL LOCOMOTIVE ENGINEER,

Fireman, and Engine-Boy. Comprising a Historical Notice of the Pioneer Locomotive Engines and their Inventors. By MICHAEL REYNOLDS. Second Edition, with Revised Appendix. Crown 8vo, cloth. 4/6
 "From the technical knowledge of the author, it will appeal to the railway man of to-day more forcibly than anything written by Mr. Stretton."—*English Mechanic*.
 "We should be glad to see this book in the possession of everyone in the kingdom who has ever laid, or is to lay, hands on a locomotive engine."—*Iron*.

CONTINUOUS RAILWAY BRAKES.

A Practical Treatise on the several Systems in Use in the United Kingdom: their Construction and Performance. By MICHAEL REYNOLDS. Large crown 8vo, cloth 9/-
 "A popular explanation of the different brakes. It will be of great assistance in forming public opinion, and will be studied with benefit by those who take an interest in the brake."—*English Mechanic*.

STATIONARY ENGINE DRIVING.

A Practical Manual for Engineers in Charge of Stationary Engines. By MICHAEL REYNOLDS. Sixth Edition. With Plates and Woodcuts. Crown 8vo, cloth. 4/6
 "The author is thoroughly acquainted with his subjects, and his advice on the various points treated is clear and practical."—*Engineering*.
 "Our author leaves no stone unturned. He is determined that his readers shall not only know something about the stationary engine, but all about it."—*Engineer*.

ENGINE-DRIVING LIFE.

Stirring Adventures and Incidents in the Lives of Locomotive Engine-Drivers. By MICHAEL REYNOLDS. Third Edition. Crown 8vo, cloth. 1/6
 "From first to last perfectly fascinating. Wilkie Collins's most thrilling conceptions are thrown into the shade by true incidents, endless in their variety, related in every page."—*North British Mail*.

THE ENGINEMAN'S POCKET COMPANION,

And Practical Educator for Enginemen, Boiler Attendants, and Mechanics. By MICHAEL REYNOLDS. With Forty-five Illustrations and numerous Diagrams. Fourth Edition, Revised. Royal 18mo, strongly bound for pocket wear. 3/6
 "This admirable work is the honest workmanship of a competent engineer."—*Glasgow Herald*.
 "A most meritorious work, giving in a succinct and practical form all the information an engineminder desirous of mastering the scientific principles of his daily calling would require."—*The Miller*.

CIVIL ENGINEERING, SURVEYING, ETC.

LIGHT RAILWAYS FOR THE UNITED KINGDOM, INDIA, AND THE COLONIES.

A Practical Handbook setting forth the Principles on which Light Railways should be Constructed, Worked, and Financed; and detailing the cost of Construction, Equipment, Revenue and Working Expenses. By J. C. MACKAY, F.G.S., A.M.Inst.C.E. Illustrated with Plates and Diagrams. 8vo, cloth **15/-**

"Mr. Mackay's volume is clearly and concisely written, admirably arranged, and freely illustrated. The book is exactly what has been long wanted. We recommend it to all interested in the subject. It is sure to have a wide sale."—*Railway News*.

TUNNELLING.

A Practical Treatise. By C. PRELINI, C.E., with Additions by C. S. HILL, C.E. With 150 Diagrams and Illustrations. Royal 8vo, cloth.

[Just Published. Net. **16/-**

PRACTICAL TUNNELLING.

Explaining in detail Setting-out the Works, Shaft-sinking, and Heading-driving, Ranging the Lines and Levelling underground, Sub-Excavating, Timbering and the Construction of the Brickwork of Tunnels. By F. W. SIMMS, M.Inst. C.E. Fourth Edition, Revised and Further Extended, including the most Recent (1895) Examples of Sub-aqueous and other Tunnels by D. KINNEAR CLARK, M.Inst.C.E. With 34 Folding Plates. Imperial 8vo, cloth. **£2 2s.**

"The present (1896) edition has been brought right up to date, and is thus rendered a work to which civil engineers generally should have ready access, and to which engineers who have construction work can hardly afford to be without, but which to the younger members of the profession is invaluable, as from its pages they can learn the state to which the science of tunnelling has attained."—*Railway News*.

THE WATER SUPPLY OF TOWNS, AND THE CONSTRUCTION OF WATER-WORKS.

A Practical Treatise for the Use of Engineers and Students of Engineering. By W. K. BURTON, A.M.Inst.C.E., Consulting Engineer to the Tokyo Water-Works. Second Edition, Revised and Extended. With numerous Plates and Illustrations. Super-royal 8vo, buckram.

[Just Published. **25/-**

I. INTRODUCTORY.—II. DIFFERENT QUALITIES OF WATER.—III. QUANTITY OF WATER TO BE PROVIDED.—IV. ON ASCERTAINING WHETHER A PROPOSED SOURCE OF SUPPLY IS SUFFICIENT.—V. ON ESTIMATING THE STORAGE CAPACITY REQUIRED TO BE PROVIDED.—VI. CLASSIFICATION OF WATERWORKS.—VII. IMPOUNDING RESERVOIRS.—VIII. EARTHWORK DAMS.—IX. MASONRY DAMS.—X. THE PURIFICATION OF WATER.—XI. SETTLING RESERVOIRS.—XII. SAND FILTRATION.—XIII. PURIFICATION OF WATER BY ACTION OF IRON, SOFTENING OF WATER BY ACTION OF LIME, NATURAL FILTRATION.—XIV. SERVICE OR CLEAN WATER RESERVOIRS.—WATER TOWERS—STAND PIPES.—XV. THE CONNECTION OF SETTLING RESERVOIRS, FILTER BEDS AND SERVICE RESERVOIRS.—XVI. PUMPING MA-

CHINERY.—XVII. FLOW OF WATER IN CONDUITS.—PIPES AND OPEN CHANNELS.—XVIII. DISTRIBUTION SYSTEMS.—XIX. SPECIAL PROVISIONS FOR THE EXTINCTION OF FIRE.—XX. PIPES FOR WATERWORKS.—XXI. PREVENTION OF WASTE OF WATER.—XXII. VARIOUS APPLIANCES USED IN CONNECTION WITH WATERWORKS.

APPENDIX I. By PROF. JOHN MILNE, F.R.S.—CONSIDERATIONS CONCERNING THE PROBABLY EFFECTS OF EARTHQUAKES ON WATERWORKS, AND THE SPECIAL PRECAUTIONS TO BE TAKEN IN EARTHQUAKE COUNTRIES.

APPENDIX II. By JOHN DE RIJKE, C.E.—ON SAND DUNES AND DUNE SAND AS A SOURCE OF WATER SUPPLY.

"The chapter upon filtration of water is very complete, and the details of construction well illustrated. . . . The work should be specially valuable to civil engineers engaged in work in Japan, but the interest is by no means confined to that locality."—*Engineer*.

"We congratulate the author upon the practical commonsense shown in the preparation of this work. . . . The plates and diagrams have evidently been prepared with great care, and cannot fail to be of great assistance to the student."—*Builder*.

RURAL WATER SUPPLY.

A Practical Handbook on the Supply of Water and Construction of Waterworks for small Country Districts. By ALLAN GREENWELL, A.M.I.C.E., and W. T. CURRY, A.M.I.C.E., F.G.S. With Illustrations. Second Edition, Revised. Crown 8vo, cloth.

[Just Published. **5/-**

"We conscientiously recommend it as a very useful book for those concerned in obtaining water for small districts, giving a great deal of practical information in a small compass."—*Builder*.

"The volume contains valuable information upon all matters connected with water supply. . . . It is full of details on points which are continually before waterworks engineers."—*Nature*.

THE WATER SUPPLY OF CITIES AND TOWNS.

By WILLIAM HUMBER, A.-M.Inst.C.E., and M.Inst.M.E., Author of "Cast and Wrought Iron Bridge Construction," &c., &c. Illustrated with 50 Double Plates, 1 Single Plate, Coloured Frontispiece, and upwards of 250 Woodcuts, and containing 400 pages of Text. Imp. 4to, elegantly and substantially half-bound in morocco.

[Net. £6 6s.]

LIST OF CONTENTS.

I. HISTORICAL SKETCH OF SOME OF THE MEANS THAT HAVE BEEN ADOPTED FOR THE SUPPLY OF WATER TO CITIES AND TOWNS.—II. WATER AND THE FOREIGN MATTERS USUALLY ASSOCIATED WITH IT.—III. RAINFALL AND EVAPORATION.—IV. SPRINGS AND THE WATER-BEARING FORMATIONS OF VARIOUS DISTRICTS.—V. MEASUREMENT AND ESTIMATION OF THE FLOW OF WATER.—VI. ON THE SELECTION OF THE SOURCE OF SUPPLY.—VII. WELLS.—VIII. RESERVOIRS.—IX. THE PURIFICATION OF WATER.—X. PUMPS.—XI. PUMPING MACHINERY.—XII. CONDUITS.—	XIII. DISTRIBUTION OF WATER.—XIV. METERS, SERVICE PIPES, AND HOUSE FITTINGS.—XV. THE LAW AND ECONOMY OF WATER WORKS.—XVI. CONSTANT AND INTERMITTENT SUPPLY.—XVII. DESCRIPTION OF PLATES.—APPENDICES, GIVING TABLES OF RATES OF SUPPLY, VELOCITIES, &c., &c., TOGETHER WITH SPECIFICATIONS OF SEVERAL WORKS ILLUSTRATED, AMONG WHICH WILL BE FOUND: ABERDEEN, BIDEFORD, CANTERBURY, DUNDEE, HALIFAX, LAMBETH, ROTHERHAM, DUBLIN, AND OTHERS.
---	---

"The most systematic and valuable work on the subject of water supply ever published in any other language. . . . Mr. Humber's . . . book is much more distinctive of French and German than of English."

HYDRAULIC POWER ENGINEERING.

A Practical Manual on the Concentration and Transmission of Power by Hydraulic Machinery. By G. CROYDON MARKS, A.M.Inst.C.E. With nearly 200 Illustrations. 8vo, cloth.

[Just Published. Net. 9/-]

SUMMARY OF CONTENTS.

PRINCIPLES OF HYDRAULICS.—THE FLOW OF WATER.—HYDRAULIC PRESSURES.—MATERIAL.—TEST LOAD.—PACKINGS FOR SLIDING SURFACES.—PIPE JOINTS.—CONTROLLING VALVES.—PLATFORM LIFTS.—WORKSHOP AND FOUNDRY CRANES.—WAREHOUSE AND DOCK CRANES.—HYDRAULIC ACCUMULATORS.—PRESSES FOR BALING AND OTHER PURPOSES.—SHEET METAL.	WORKING AND FORGING MACHINERY.—HYDRAULIC RIVETERS.—HAND AND POWER PUMPS.—STEAM PUMPS.—TURBINES.—IMPULSE TURBINES.—REACTION TURBINES.—DESIGN OF TURBINES IN DETAIL.—WATER WHEELS.—HYDRAULIC ENGINES.—RECENT ACHIEVEMENTS.—PRESSURE OF WATER.—ACTION OF PUMPS, &c.
--	--

"We have nothing but praise for this thoroughly valuable work. The author has succeeded in rendering his subject interesting as well as instructive."—*Practical Engineer*.

"Can be unhesitatingly recommended as a useful and up-to-date manual on hydraulic transmission and utilisation of power."—*Mechanical World*.

HYDRAULIC TABLES, CO-EFFICIENTS, & FORMULÆ.

For Finding the Discharge of Water from Orifices, Notches, Weirs, Pipes, and Rivers. With New Formulae, Tables, and General Information on Rain-fall, Catchment-Basins, Drainage, Sewerage, Water Supply for Towns and Mill Power. By JOHN NEVILLE, Civil Engineer, M.R.I.A. Third Edition, carefully Revised, with considerable Additions. Numerous Illustrations. Crown 8vo.

14/-

"It is, of all English books on the subject, the one nearest to completeness."—*Architect*.

HYDRAULIC MANUAL.

Consisting of Working Tables and Explanatory Text. Intended as a Guide in Hydraulic Calculations and Field Operations. By LOUIS D'A. JACKSON, Author of "Aid to Survey Practice," "Modern Metrology," &c. Fourth Edition, Enlarged. Large crown 8vo, cloth.

16/-

"The author has constructed a manual which may be accepted as a trustworthy guide to this branch of the engineer's profession."—*Engineering*.

WATER ENGINEERING.

A Practical Treatise on the Measurement, Storage, Conveyance, and Utilisation of Water for the Supply of Towns, for Mill Power, and for other Purposes. By CHARLES SLAGG, A.M.Inst.C.E. Second Edition. Crown 8vo, cloth.

7/6

"As a small practical treatise on the water supply of towns, and on some applications of water-power, the work is in many respects excellent."—*Engineering*.

"The author has collated the results deduced from the experiments of the most eminent authorities, and has presented them in a compact and practical form, accompanied by very clear and detailed explanations. . . . The application of water as a motive power is treated very carefully and exhaustively."—*Builder*.

THE RECLAMATION OF LAND FROM TIDAL WATERS.

A Handbook for Engineers, Landed Proprietors, and others interested in Works of Reclamation. By ALEXANDER BEAZELEY, M.Inst.C.E. With Illustrations. 8vo, cloth. [Just Published. Net 10/6]

"The book shows in a concise way what has to be done in reclaiming land from the sea, and the best way of doing it. The work contains a great deal of practical and useful information which cannot fail to be of service to engineers entrusted with the enclosure of salt marshes, and to land owners intending to reclaim land from the sea."—*The Engineer*.

"The author has carried out his task efficiently and well, and his book contains a large amount of information of great service to engineers and others interested in works of reclamation."—*Nature*.

MASONRY DAMS FROM INCEPTION TO COMPLETION.

Including numerous Formulae, Forms of Specification and Tender, Pocket Diagram of Forces, &c. For the use of Civil and Mining Engineers. By C. F. COURNTY, M.Inst.C.E. 8vo, cloth. 9/-

"The volume contains a good deal of valuable data, and furnishes the engineer with practical advice. Many useful suggestions will be found in the remarks on site and position, location of dam, foundations and construction."—*Building News*.

RIVER BARS.

The Causes of their Formation, and their Treatment by "Induced Tidal Scour;" with a Description of the Successful Reduction by this Method of the Bar at Dublin. By I. J. MANN, Assist. Eng. to the Dublin Port and Docks Board. Royal 8vo, cloth. 7/6

"We recommend all interested in harbour works—and, indeed, those concerned in the improvements of rivers generally—to read Mr. Mann's interesting work."—*Engineer*.

DRAINAGE OF LANDS, TOWNS, AND BUILDINGS.

By G. D. DEMPSEY, C.E. Revised, with large Additions on RECENT PRACTICE IN DRAINAGE ENGINEERING, by D. KINNEAR CLARK, M.Inst.C.E. Third Edition. Fcap. 8vo, cloth. 4/6

"The new matter added to Mr. Dempsey's excellent work is characterised by the comprehensive grasp and accuracy of detail for which the name of Mr. D. K. Clark is a sufficient voucher."—*Athenaeum*.

TRAMWAYS: THEIR CONSTRUCTION & WORKING.

Embracing a Comprehensive History of the System; with an exhaustive Analysis of the Various Modes of Traction, including Horse Power, Steam, Cable Traction, Electric Traction, &c.; a Description of the Varieties of Rolling Stock; and ample Details of Cost and Working Expenses. New Edition, Thoroughly Revised, and Including the Progress recently made in Tramway Construction, &c. &c. By D. KINNEAR CLARK, M.Inst.C.E. With 400 Illustrations. 8vo, 780 pages, buckram. 28/-

"The new volume is one which will rank, among tramway engineers and those interested in tramway working, with the author's world-famed book on railway machinery."—*The Engineer*.

PRACTICAL SURVEYING.

A Text-Book for Students preparing for Examinations or for Surveying work in the Colonies. By GEORGE W. USILL, A.M.I.C.E. With 41 Plates, and upwards of 330 Illustrations. Sixth Edition. Including Tables of Natural Sines, Tangents, Secants, &c. Crown 8vo, 7/6 cloth; or, on THIN PAPER, leather, gilt edges, rounded corners, for pocket use. [Just Published. 12/6

"The best forms of instruments are described as to their construction, uses and modes of employment, and there are innumerable hints on work and equipment such as the author, in his experience as surveyor, draughtsman and teacher, has found necessary, and which the student in his inexperience will find most serviceable."—*Engineer*.

"The latest treatise in the English language on surveying, and we have no hesitation in saying that the student will find it a better guide than any of its predecessors. Deserves to be recognised as the first book which should be put in the hands of a pupil of Civil Engineering."—*Architect*.

AID TO SURVEY PRACTICE.

For Reference in Surveying, Levelling, and Setting-out; and in Route Surveys of Travellers by Land and Sea. With Tables, Illustrations, and Records. By LOUIS D'A. JACKSON, A.M.I.C.E. Second Edition, Enlarged. 8vo, cloth 12/6

"Mr. Jackson has produced a valuable *vade-mecum* for the surveyor. We can recommend this book as containing an admirable supplement to the teaching of the accomplished surveyor."—*Athenaeum*.

"The author brings to his work a fortunate union of theory and practical experience which, aided by a clear and lucid style of writing, renders the book a very useful one."—*Builder*.

SURVEYING WITH THE TACHEOMETER.

A Practical Manual for the use of Civil and Military Engineers and Surveyors. Including two series of Tables computed for the Reduction of Readings in Sexagesimal and in Decimal. By NEIL KENNEDY, M.Inst.C.E. With Diagrams and Plates. Demy 8vo, cloth. [Just Published. Net 10/-]

"The work is very clearly written, and should remove all difficulties in the way of any surveyor desirous of making use of this useful and rapid instrument."—*Nature*.

ENGINEER'S & MINING SURVEYOR'S FIELD BOOK.

Consisting of a Series of Tables, with Rules, Explanations of Systems, and use of Theodolite for Traverse Surveying and Plotting the Work with minute accuracy by means of Straight Edge and Set Square only; Levelling with the Theodolite; Setting-out Curves with and without the Theodolite; Earthwork Tables, &c. By W. DAVIS HASKOLL, C.E. With numerous Woodcuts. Fourth Edition, Enlarged. Crown 8vo, cloth 12/-

"The book is very handy; the separate tables of sines and tangents to every minute will make it useful for many other purposes, the genuine traverse tables existing all the same."—*Athenaeum*.

LAND AND MARINE SURVEYING.

In Reference to the Preparation of Plans for Roads and Railways; Canals, Rivers, Towns' Water Supplies; Docks and Harbours. With Description and Use of Surveying Instruments. By W. DAVIS HASKOLL, C.E. Second Edition, Revised, with Additions. Large crown 8vo, cloth 9/-

"This book must prove of great value to the student. We have no hesitation in recommending it, feeling assured that it will more than repay a careful study."—*Mechanical World*.

"A most useful book for the student. We can strongly recommend it as a carefully-written and valuable text-book. It enjoys a well-deserved repute among surveyors."—*Builder*.

PRINCIPLES AND PRACTICE OF LEVELLING.

Showing its Application to purposes of Railway and Civil Engineering in the Construction of Roads; with Mr. TELFORD's Rules for the same. By W. SIMMS, M.Inst.C.E. Eighth Edition, with Law's Practical Examples for Setting-out Railway Curves, and TRAUTWINE'S Field Practice of Laying-out Circular Curves. With 7 Plates and numerous Woodcuts, 8vo. 8/6

* * TRAUTWINE on CURVES may be had separate 5/-

"The text-book on levelling in most of our engineering libraries is now superseded by this work, Sir Charles Warren has revised the entire work, and made such additions as were necessary to bring every portion of the contents up to the present date."—*Broad Arrow*.

AN OUTLINE OF THE METHOD OF CONDUCTING A TRIGONOMETRICAL SURVEY,

For the Formation of Geographical and Topographical Maps and Plans, Military Reconnaissance, LEVELLING, &c., with Useful Problems, Formulae, and Tables. By Lieut.-General FROME, R.E. Fourth Edition, Revised and partly Re-written by Major-General Sir CHARLES WARREN, G.C.M.G., R.E. With 19 Plates and 115 Woodcuts, royal 8vo, cloth 16/-

"No words of praise from us can strengthen the position so well and so steadily maintained by this work. Sir Charles Warren has revised the entire work, and made such additions as were necessary to bring every portion of the contents up to the present date."—*Broad Arrow*.

TABLES OF TANGENTIAL ANGLES & MULTIPLES.

For Setting-out Curves from 5 to 200 Radius. By A. BEAZELEY, M.Inst.C.E. Sixth Edition, Revised. With an Appendix on the use of the Tables for Measuring up Curves. Printed on 50 Cards, and sold in a cloth box, waistcoat-pocket size. [Just Published. 3/6

"Each table is printed on a small card, which, being placed on the theodolite, leaves the hands free to manipulate the instrument—no small advantage as regards the rapidity of work."—*Engineer*.

"Very handy: a man may know that all his day's work must fall on two of these cards, which he puts into his own card-case, and leaves the rest behind."—*Athenaeum*.

HANDY GENERAL EARTHWORK TABLES.

Giving the Contents in Cubic Yards of Centre and Slopes of Cuttings and Embankments from 3 inches to 80 feet in Depth or Height, for use with either 66 feet Chain or 100 feet Chain. By J. H. WATSON BUCK, M.Inst.C.E. On a Sheet mounted in cloth case 3/6

EARTHWORK TABLES.

Showing the Contents in Cubic Yards of Embankments, Cuttings, &c., of Heights or Depths up to an average of 80 feet. By JOSEPH BROADBENT, C.E., and FRANCIS CAMPIN, C.E. Crown 8vo, cloth 5/-

"The way in which accuracy is attained, by a simple division of each cross section into three elements, two of which are constant and one variable, is ingenious."—*Athenaeum*.

A MANUAL ON EARTHWORK.

By ALEX. J. GRAHAM, C.E. With numerous Diagrams. Second Edition, 18mo, cloth 2/6

THE CONSTRUCTION OF LARGE TUNNEL SHAFTS.

A Practical and Theoretical Essay. By J. H. WATSON BUCK, M.Inst.C.E., Resident Engineer, L. and N. W. R. With Folding Plates, 8vo, cloth 12/-

"Many of the illustrations have great extreme practical value to the mason, and the observations on the form of a shaft, the choice of stone, and the construction of the templates, will be found of considerable interest."—*Engineering News*.

"Will be regarded by civil engineers as of the utmost value, and calculated to save much time and obviate many mistakes."—*Colliery Guardian*.

CAST & WROUGHT IRON BRIDGE CONSTRUCTION.

(A Complete and Practical Treatise on), including Iron Foundations. In Three Parts—Theoretical, Practical, and Descriptive. By WILLIAM HUMBER, A.-M.Inst.C.E., and M.Inst.M.E. Third Edition, Revised and much improved, with 115 Double Plates (20 of which now first appear in this edition), and numerous Additions to the Text. In 2 vols., imp. 4to, half-bound in morocco.

£6 16s. 6d.

"A very valuable contribution to the standard literature of civil engineering. In addition to elevations, plans, and sections, large scale details are given, which very much enhance the instructive worth of those illustrations."—*Civil Engineer and Architect's Journal*.

"Mr. Humber's stately volumes, lately issued—in which the most important bridges erected during the last five years, under the direction of the late Mr. Brunel, Sir W. Cubitt, Mr. Hawkin, Mr. Pagan, Mr. Fowler, Mr. Hemans, and others among our most eminent engineers, are drawn and specified in great detail."—*Engineer*.

ESSAY ON OBLIQUE BRIDGES.

(Practical and Theoretical.) With 13 large Plates. By the late GEORGE WATSON BUCK, M.I.C.E. Fourth Edition, revised by his Son, J. H. WATSON BUCK, M.I.C.E.; and with the addition of Description to Diagrams for Facilitating the Construction of Oblique Bridges, by W. H. BARLOW, M.I.C.E. Royal 8vo, cloth

12/-

"The standard text-book for all engineers regarding skew arches is Mr. Buck's treatise, and it would be impossible to consult a better."—*Engineer*.

"Mr. Buck's treatise is recognised as a standard text-book, and his treatment has divested the subject of many of the intricacies supposed to belong to it. As a guide to the engineer and architect, on a confessedly difficult subject, Mr. Buck's work is unsurpassed."—*Building News*.

THE CONSTRUCTION OF OBLIQUE ARCHES.

(A practical Treatise on). By JOHN HART. Third Edition, with Plates. Imperial 8vo, cloth 8/-

GRAPHIC AND ANALYTIC STATICS.

In their Practical Application to the Treatment of Stresses in Roofs, Solid Girders, Lattice, Bowstring, and Suspension Bridges, Braced Iron Arches and Piers, and other Frameworks. By R. HUDSON GRAHAM, C.E. Containing Diagrams and Plates to Scale. With numerous Examples, many taken from existing Structures. Specially arranged for Class-work in Colleges and Universities. Second Edition, Revised and Enlarged. 8vo, cloth 16/-

"Mr. Graham's book will find a place wherever graphic and analytic statics are used or studied."—*Engineer*.

"The work is excellent from a practical point of view, and has evidently been prepared with much care. The directions for working are ample, and are illustrated by an abundance of well-selected examples. It is an excellent text-book for the practical draughtsman."—*Athenaeum*.

GRAPHIC TABLE.

For Facilitating the Computation of the Weights of Wrought Iron and Steel Girders, &c., for Parliamentary and other Estimates. By J. H. WATSON BUCK, M.Inst.C.E. On a Sheet 2/6

PRACTICAL GEOMETRY.

For the Architect, Engineer, and Mechanic. Giving Rules for the Delineation and Application of various Geometrical Lines, Figures, and Curves. By E. W. TARN, M.A., Architect. 8vo, cloth. 9/-

"No book with the same objects in view has ever been published in which the clearness of the rules laid down and the illustrative diagrams have been so satisfactory."—*Scotsman*.

THE GEOMETRY OF COMPASSES.

Or, Problems Resolved by the mere Description of Circles, and the use of Coloured Diagrams and Symbols. By OLIVER BYRNE. Coloured Plates. Crown 8vo, cloth. 3/6

HANDY BOOK FOR THE CALCULATION OF STRAINS

In Girders and Similar Structures and their Strength. Consisting of Formulae and Corresponding Diagrams, with numerous details for Practical Application, &c. By WILLIAM HUMBER, A.-M.Inst.C.E., &c. Fifth Edition. Crown 8vo, with nearly 100 Woodcuts and 3 Plates, cloth. 7/6

"The formulæ are neatly expressed, and the diagrams good."—*Athenaeum*.

"We heartily commend this really handy book to our engineer and architect readers."—*English Mechanic*.

TRUSSES OF WOOD AND IRON.

Practical Applications of Science in Determining the Stresses, Breaking Weights, Safe Load, &c., and Details of Construction. With Complete Working Drawings by W. W. GRIFFITHS, Surveyor, Assistant Master, Tramore School of Science and Art. Oblong 8vo, cloth. 4/6

"This handy little book enters so minutely into every detail connected with the construction of roof trusses that no student need be ignorant of these matters."—*Practical Engineer*.

THE STRAINS ON STRUCTURES OF IRONWORK.

With Practical Remarks on Iron Construction. By F. W. SHEILDS, M.I.C.E. 8vo, cloth. 5/-

A TREATISE ON THE STRENGTH OF MATERIALS.

With Rules for application in Architecture, the Construction of Suspension Bridges, Railways, &c. By PETER BARLOW, F.R.S. A New Edition, revised by his Sons, P. W. BARLOW, F.R.S., and W. H. BARLOW, F.R.S.; to which are added, Experiments by HODGKINSON, FAIRBAIRN, and KIRKALDY; and Formulae for Calculating Girders, &c. Arranged and Edited by WM. HUMBER, A.-M.Inst.C.E. Demy 8vo, 400 pp., with 19 large Plates and numerous Woodcuts, cloth. 18/-

"Valuable alike to the student, tyro, and the experienced practitioner. It will always rank in future, as it has hitherto done, as the standard treatise on that particular subject."—*Engineer*.

"As a scientific work of the first class, it deserves a foremost place on the bookshelves of every civil engineer and practical mechanic."—*English Mechanic*.

STRENGTH OF CAST IRON AND OTHER METALS.

By THOMAS TREDGOLD, C.E. Fifth Edition, including HODGKINSON'S Experimental Researches. 8vo, cloth. 12/-

SAFE RAILWAY WORKING.

A Treatise on Railway Accidents, their Cause and Prevention; with a Description of Modern Appliances and Systems. By CLEMENT E. STRETTON, C.E., Vice-President and Consulting Engineer, Amalgamated Society of Railway Servants. With Illustrations and Coloured Plates. Third Edition, Enlarged. Crown 8vo, cloth. 3/6

"A book for the engineer, the directors, the managers; and, in short, all who wish for information on railway matters will find a perfect encyclopaedia in 'Safe Railway Working'."—*Railway Review*.

"We commend the remarks on railway signalling to all railway managers, especially where a uniform code and practice is advocated."—*Herepath's Railway Journal*.

"The author may be congratulated on having collected, in a very convenient form, much valuable information on the principal questions affecting the safe working of railways."—*Railway Engineer*.

EXPANSION OF STRUCTURES BY HEAT.

By JOHN KEILY, C.E., late of the Indian Public Works Department. Crown 8vo, cloth. 3/6

"The aim the author has set before him, viz., to show the effects of heat upon metallic and other structures, is a laudable one, for this is a branch of physics upon which the engineer or architect can find but little reliable and comprehensive data in books."—*Builder*.

THE PROGRESS OF MODERN ENGINEERING.

Complete in Four Volumes, imperial 4to, half-morocco, price £12 12s.

Each volume sold separately, as follows:—

FIRST SERIES. Comprising Civil, Mechanical, Marine, Hydraulic, Railway, Bridge, and other Engineering Works, &c. By WILLIAM HUMBER, A.-M. Inst.C.E., &c. Imp. 4to, with 36 Double Plates, drawn to a large scale. Photographic Portrait of John Hawkshaw, C.E., F.R.S., &c., and copious descriptive Letterpress, Specifications, &c., half-morocco £3 3s.

LIST OF THE PLATES AND DIAGRAMS.

VICTORIA STATION AND ROOF, L. B. & S. C. R. (8 PLATES); SOUTHPORT PIER (2 PLATES); VICTORIA STATION AND ROOF, L. C. & D. AND G. W. R. (6 PLATES); ROOF OF CREMORE MUSIC HALL; BRIDGE OVER G. N. RAILWAY; ROOF OF STATION, DUTCH RHENISH RAIL (2 PLATES); BRIDGE OVER THE THAMES, WEST LONDON EXTENSION RAILWAY (5 PLATES); ARMOUR PLATES: SUSPENSION BRIDGE, THAMES (4 PLATES); THE ALLEN ENGINE; SUSPENSION BRIDGE, AVON (3 PLATES); UNDERGROUND RAILWAY (3 PLATES).

"Handsomely lithographed and printed. It will find favour with many who desire to preserve in a permanent form copies of the plans and specifications prepared for the guidance of the contractors for many important engineering works."—*Engineer.*

HUMBER'S MODERN ENGINEERING.

SECOND SERIES. Imperial 4to, with 3 Double Plates, Photographic Portrait of Robert Stephenson, C.E., M.P., F.R.S., &c., and copious descriptive Letterpress, Specifications, &c., half-morocco £3 3s.

LIST OF THE PLATES AND DIAGRAMS.

BIRKENHEAD DOCKS, LOW WATER BASIN (15 PLATES); CHARING CROSS STATION ROOF, C. C. RAILWAY (3 PLATES); DIGSWELL VIADUCT, GREAT NORTHERN RAILWAY; ROBBERY WOOD VIADUCT, GREAT NORTHERN RAILWAY; IRON PERMANENT WAY; CLYDACH VIADUCT; MERTHYR, TREDEGAR, AND ABERGAVENNY RAILWAY; EBDW VIADUCT, MERTHYR, TREDEGAR, AND ABERGAVENNY RAILWAY; COLLEGE WOOD VIADUCT, CORNWALL RAILWAY; DUBLIN WINTER PALACE ROOF (3 PLATES); BRIDGE OVER THE THAMES, L. C. and D. RAILWAY (6 PLATES); ALBERT HARBOUR, GREENOCK (4 PLATES).

"Mr. Humber has done '... true service, by the fine collection of examples he has here brought before the ..."—*Practical Mechanic's Journal.*

HUMBER'S MODERN ENGINEERING.

THIRD SERIES. Imp. 4to, with 40 Double Plates, Photographic Portrait of J. R. McClean, late Pres. Inst. C.E., and copious descriptive Letterpress, Specifications, &c., half-morocco £3 3s.

LIST OF THE PLATES AND DIAGRAMS.

MAIN DRAINAGE, METROPOLIS.—*North Side.*—MAP SHOWING INTERCEPTION OF SEWERS; MIDDLE LEVEL SEWER (2 PLATES); OUTFALL SEWER, BRIDGE OVER RIVER LEA (3 PLATES); OUTFALL SEWER, BRIDGE OVER MARSH LANE, NORTH WOOLWICH RAILWAY, AND BOW AND BARKING RAILWAY JUNCTION; OUTFALL SEWER, BRIDGE OVER BOW AND BARKING RAILWAY (3 PLATES); OUTFALL SEWER, BRIDGE OVER EAST LONDON WATERWORK' FEEDER (2 PLATES); OUTFALL SEWER RESERVOIR (2 PLATES); OUTFALL SEWER, TUMBLING BAY AND OUTLET; OUTFALL SEWER, PENSTOCKS. *South Side.*—OUTFALL SEWER, BERMONDSEY BRANCH (2 PLATES); OUTFALL SEWER, RESERVOIR, AND OUTLET (4 PLATES); OUTFALL SEWER, FILTH HOIST; SECTIONS OF SEWERS (NORTH AND SOUTH SIDES).

THAMES EMBANKMENT.—SECTION OF RIVER WALL; STEAMBOAT PIER, WESTMINSTER (2 PLATES); LANDING STAIRS BETWEEN CHARING CROSS AND WATERLOO BRIDGES; YORK GATE (2 PLATES); OVERFLOW AND OUTLET AT SAVOY STREET SEWER (3 PLATES); STEAMBOAT PIER, WATERLOO BRIDGE (3 PLATES); JUNCTION OF SEWERS, PLANS AND SECTIONS; GULLIES, PLANS, AND SECTIONS; ROLLING STOCK; GRANITE AND IRON FORTS.

"The drawings have a constantly increasing value, and whoever desires to possess clear representations of the two great works carried out by our Metropolitan Board will obtain Mr. Humber's volume."—*Engineer.*

HUMBER'S MODERN ENGINEERING.

FOURTH SERIES. Imp. 4to, with 36 Double Plates, Photographic Portrait of John Fowler, late Pres. Inst. C.E., and copious descriptive Letterpress, Specifications, &c., half morocco £3 3s.

LIST OF THE PLATES AND DIAGRAMS.

ABBEY MILLS PUMPING STATION, MAIN DRAINAGE, METROPOLIS (4 PLATES); BARROW DOCKS (5 PLATES); MANQUIE VIADUCT, SANTIAGO AND VALPARAISO RAILWAY (2 PLATES); ADAM'S LOCOMOTIVE, ST. HELEN'S CANAL RAILWAY (2 PLATES); CANNON STREET STATION ROOF, CHARING CROSS RAILWAY (3 PLATES); ROAD BRIDGE OVER THE RIVER MOKA (2 PLATES); TELEGRAPHIC APPARATUS FOR MESOPOTAMIA; VIADUCT OVER THE RIVER WYK, MIDLAND RAILWAY (3 PLATES); ST. GERMAN'S VIADUCT, CORNWALL RAILWAY (2 PLATES); WROUGHT-IRON CYLINDER FOR DIVING BELL; MILL-WALL DOCKS (6 PLATES); MILROY'S PATENT EXCAVATOR; METROPOLITAN DISTRICT RAILWAY (6 PLATES); HARBOURS, PORTS AND BREAKWATERS (3 PLATES).

"We gladly welcome another year's issue of this valuable publication from the able pen of Mr. Humber. The accuracy and general excellence of his work are well known, while its usefulness in giving the measurements and details of some of the largest examples of engineering, as carried out by the most eminent men in the profession, cannot be too highly praised."—*Engineer.*

MARINE ENGINEERING, SHIPBUILDING, NAVIGATION, ETC.

THE NAVAL ARCHITECT'S AND SHIPBUILDER'S POCKET-BOOK

Of Formulae, Rules, and Tables, and Marine Engineer's and Surveyor's Handy Book of Reference. By CLEMENT MACKROW, M.I.N.A. Seventh Edition, 700 pages, with 300 Illustrations. Fcap., leather.

[Just Published. 12/6

SUMMARY OF CONTENTS.

SIGNS AND SYMBOLS, DECIMAL FRACTIONS.—TRIGONOMETRY.—PRACTICAL GEOMETRY.—MENSURATION.—CENTRES AND MOMENTS OF FIGURES.—MOMENTS OF INERTIA AND RADII OF GYRATION.—ALGEBRAICAL EXPRESSIONS FOR SIMPSON'S RULES.—MECHANICAL PRINCIPLES.—CENTRE OF GRAVITY.—LAWS OF MOTION.—DISPLACEMENT, CENTRE OF BUOYANCY.—CENTRE OF GRAVITY OF SHIP'S HULL.—STABILITY CURVES AND METACENTRES.—SEA AND SHALLOW-WATER WAVES.—ROLLING OF SHIPS.—PROPULSION AND RESISTANCE OF VESSELS.—SPEED TRIALS.—SAILING, CENTRE OF EFFORT.—DISTANCES DOWN RIVERS, COAST LINES.—STEERING AND RUDDERS OF VESSELS.—LAUNCHING CALCULATIONS AND VELOCITIES.—WEIGHT OF MATERIAL AND GEAR.—GUN PARTICULARS AND WEIGHT.—STANDARD GAUGES.—RIVETED JOINTS AND RIVETING.—STRENGTH AND TESTS OF MATERIALS.—BINDING AND SHEARING STRESSES, ETC.—STRENGTH OF SHAFTING, PILLARS, WHEELS, ETC.—HYDRAULIC DATA, ETC.—CONIC SECTIONS, CATENARIAN CURVES.—MECHANICAL POWERS, WORK.—BOARD OF TRADE REGULATIONS FOR BOILERS AND ENGINES.—BOARD OF TRADE REGULATIONS FOR SHIPS.—LLOYD'S RULES FOR BOILERS.—LLOYD'S WEIGHT OF CHAINS.—LLOYD'S SCANTLINGS FOR SHIPS.—DATA OF ENGINES AND VESSELS.—SHIPS' FITTINGS AND TESTS.—SEASONING PRESERVING TIMBER.—MEASUREMENT OF TIMBER.—ALLOYS, PAINTS, VARNISHES.—DATA FOR STOWAGE.—ADMIRALTY TRANSPORT REGULATIONS.—RULES FOR HORSE-POWER, SCREW PROPELLERS, ETC.—PERCENTAGES FOR BUTT STRAPS, ETC.—PARTICULARS OF YACHTS.—MASTING AND RIGGING VESSELS.—DISTANCES OF FOREIGN PORTS.—TONNAGE TABLES.—VOCABULARY OF FRENCH AND ENGLISH TERMS.—ENGLISH WEIGHTS AND MEASURES.—FOREIGN WEIGHTS AND MEASURES.—DECIMAL EQUIVALENTS.—FOREIGN MONEY.—DISCOUNT AND WAGE TABLES.—USEFUL NUMBERS AND READY RECKONERS.—TABLES OF CIRCULAR MEASURES.—TABLES OF AREAS OF AND CIRCUMFERENCES OF CIRCLES.—TABLES OF AREAS OF SEGMENTS OF CIRCLES.—TABLES OF SQUARES AND CUBES AND ROOTS OF NUMBERS.—TABLES OF LOGARITHMS OF NUMBERS.—TABLES OF HYPERBOLIC LOGARITHMS.—TABLES OF NATURAL SINES, TANGENTS, ETC.—TABLES OF LOGARITHMIC SINES, TANGENTS, ETC.

"In these days of advanced knowledge a work like this is of the greatest value. It contains a vast amount of information. We hesitatingly say that it is the most valuable compilation for its specific purpose that has ever been printed. No naval architect, engineer, surveyor, seaman, wood or iron shipbuilder, can afford to be without this work."—*Nautical Magazine*.

"Should be used by all who are engaged in the construction or design of vessels. . . . Will be found to contain the most useful tables and formulae required by shipbuilders, carefully collected from the best authorities, and put together in a popular and simple form. The book is one of exceptional merit."—*Engineer*.

"The professional shipbuilder has now, in a convenient and accessible form, reliable data for solving many of the numerous problems that present themselves in the course of his work."—*Iron*.

"There is no doubt that a pocket-book of this description must be a necessity in the shipbuilding trade. . . . The volume contains a mass of useful information clearly expressed and presented in a handy form."—*Marine Engineer*.

WANNAN'S MARINE ENGINEER'S GUIDE

To Board of Trade Examinations for Certificates of Competency. Containing all latest Questions to Date, with Simple, Clear, and Correct Solutions; Elementary and Verbal Questions and Answers; Complete Set of Drawings and Statements Completed. By A. C. WANNAN, C.E., and E. W. I. WANNAN, M.I.M.E. Illustrated with numerous Engravings. Crown 8vo, 370 pages, cloth.

8/6

"The book is clearly and plainly written and avails of necessary explanations and formulas, and we consider it a very useful book for students of marine engineering."—*Nautical Magazine*.

"This is an excellent book. The young engineer went the world before him could hardly make a sounder base. The feature of the volume is its simplicity."—*Glasgow Herald*.

"The work covers all points on which information is indispensable, and does so in a manner which affords those who go to it for guidance an opportunity of not only gaining knowledge, but of testing to what extent they have succeeded in mastering the multifarious details with which the volume abounds."—*Sotsman*.

WANNAN'S MARINE ENGINEER'S POCKET-BOOK.

Containing latest Board of Trade Rules and Data for Marine Engineers. By A. C. WANNAN, C.E. Second Edition, carefully Revised. Square 18mo, with Thumb Index, leather.

5/-

"There is a great deal of useful information in this little pocket-book. It is of the rule-of-the-thumb order, and is, on that account, well adapted to the uses of the sea-going engineer."—*Engineer*.

"The work, with its many diagrams, condenses the information that is contained in the larger works on the subject, in such a manner as to be very handy for reference."—*Nautical Magazine*.

SEA TERMS, PHRASES, AND WORDS

(Technical Dictionary of) used in the English and French Languages. (English-French, French-English.) For the Use of Seamen, Engineers, Pilots, Ship-builders, Shipowners, and Ship-brokers. Compiled by W. PIRRIE, late of the African Steamship Company. Fcap. 8vo, cloth limp 5/-

"This volume will be highly appreciated by seamen, engineers, pilots, shipbuilders and ship-owners. It will be found wonderfully accurate and complete."—*Scotsman*.

"A very useful dictionary, which has long been wanted by French and English engineers, masters, officers and others."—*Shipping World*.

ELECTRIC SHIP LIGHTING.

A Handbook on the Practical Fitting and Running of Ship's Electrical Plant, for the Use of Shipowners and Builders, Marine Electricians and Sea-going Engineers in Charge. By J. W. URQUHART, Author of "Electric Light," "Dynamo Construction," &c. Second Edition, revised and extended. With numerous Illustrations. Crown 8vo, cloth [Just Published. 7/6]

MARINE ENGINEER'S POCKET-BOOK.

Consisting of useful Tables and Formulae. By FRANK PROCTOR, A.I.N.A. Third Edition. Royal 32mo, leather 4/-

"We recommend it to our readers as going far to supply a long-felt want."—*Naval Science*.

"A most useful companion to the marine engineer."—*United Service Gazette*.

ELEMENTARY MARINE ENGINEERING.

A Manual for Young Marine Engineers and Apprentices. In the Form of Questions and Answers on Metals, Alloys, Strength of Materials, Construction and Management of Marine Engines and Boilers, Geometry, &c. With an Appendix of Tables. By JOHN SHERREN BREWER, Government Marine Surveyor. Fourth Edition, small crown 8vo, cloth 1/6

"Contains valuable information for the class for whom it is intended, especially in the chapters on the management of boilers and engines."—*Nautical Magazine*.

MARINE ENGINES AND STEAM VESSELS.

A Treatise on. By ROBERT MURRAY, C.E. Eighth Edition, thoroughly Revised, with considerable Additions by the Author and by GEORGE CARLISLE, C.E., Senior Surveyor to the Board of Trade at Liverpool. Crown 8vo, cloth 4/6

PRACTICAL NAVIGATION.

Consisting of THE SAILOR'S SEA-BOOK, by JAMES GREENWOOD and W. H. ROSSER; together with the requisite Mathematical and Nautical Tables for the Working of the Problems, by HENRY LAW, C.E., and Professor J. R. YOUNG. Illustrated. 12mo, strongly half-bound 7/-

MARINE ENGINEER'S DRAWING-BOOK.

Adapted to the Requirements of the Board of Trade Examinations. By JOHN LOCKIE, C.E. With 22 Plates, Drawn to Scale. Royal 8vo, cloth 3/6

THE ART AND SCIENCE OF SAILMAKING.

By SAMUEL B. SADLER, Practical Sailmaker, late in the employment of Messrs. Ratsey and Laphorne, of Cowes and Gosport. With Plates and other Illustrations. Small 4to, cloth 12/6

"This extremely practical work gives a complete education in all the branches of the manufacture, cutting out, roping, seaming and goring. It is copiously illustrated, and will form a first-rate text-book and guide."—*Fortsomouth Times*.

CHAIN CABLES AND CHAINS.

Comprising Sizes and Curves of Links, Studs, &c., Iron for Cables and Chains, Chain Cable and Chain Making, Forming and Welding Links, Strength of Cables and Chains, Certificates for Cables, Marking Cables, Prices of Chain Cables and Chains, Historical Notes, Acts of Parliament, Statutory Tests, Charges for Testing, List of Manufacturers of Cables, &c., &c. By THOMAS W. TRAILL, F.E.R.N., M.Inst.C.E., Engineer-Surveyor-in-Chief, Board of Trade, Inspector of Chain Cable and Anchor Proving Establishments, and General Superintendent, Lloyd's Committee on Proving Establishments. With numerous Tables, Illustrations, and Lithographic Drawings. Folio, cloth, bevelled boards. £2 2s.

"It contains a vast amount of valuable information. Nothing seems to be wanting to make it a complete and standard work of reference on the subject."—*Nautical Magazine*.

MINING, METALLURGY, AND COLLIERY WORKING.

THE METALLURGY OF GOLD.

A Practical Treatise on the Metallurgical Treatment of Gold-bearing Ores. Including the Assaying, Melting, and Refining of Gold. By M. EISSLER, Mining Engineer, A.I.M.E., Member of the Institute of Mining and Metallurgy. Fifth Edition, Enlarged and Re-arranged. With over 300 Illustrations and Numerous Folding Plates. Medium 8vo, cloth. [Just Published. Net 21/-]

"This book thoroughly deserves its title of a 'Practical Treatise.' The whole process of gold mining, from the breaking of the quartz to the assay of the bullion, is described in clear and orderly narrative and with much, but not too much, fulness of detail."—*Saturday Review*.

"The work is a storehouse of information and valuable data, and we strongly recommend it to all professional men engaged in the gold-mining industry."—*Mining Journal*.

THE CYANIDE PROCESS OF GOLD EXTRACTION.

Including its Practical Application on the Witwatersrand Gold Fields in South Africa. By M. EISSLER, M.E., Author of "The Metallurgy of Gold," &c. With Diagrams and Working Drawings. Second Edition, Revised and Enlarged. 8vo, cloth. 7/6

"This book is just what was needed to acquaint mining men with the actual working of a process which is not only the most popular, but is, as a general rule, the most successful for the extraction of gold from tailings."—*Mining Journal*.

"The work will prove invaluable to all interested in gold mining, whether metallurgists or as investors."—*Chemical News*.

DIAMOND DRILLING FOR GOLD & OTHER MINERALS.

A Practical Handbook on the Use of Modern Diamond Core-Drills in Prospecting and Exploiting Mineral-bearing Properties, including Particulars of the Cost of Drilling and Working. By G. A. DENNY, M.N.E.Inst.M.E., M.I.M. & M., Klerksdorp Goldfields." Medium 8vo, 168 pp., with Illustrative Diagrams. [Just Published. 12/6]

"There is certainly scope for a work on diamond drilling, and Mr. Denny deserves grateful recognition for having filled the want. We strongly recommend every board of directors to carefully consider the value of the application of diamond drilling to auriferous deposits and, under certain conditions, to those over slate-schist, for systematic prospecting, both from the surface and underground. The author has given us a valuable volume of eminently practical data that should be in the possession of those interested in mining."—*Mining Journal*.

"Mr. Denny's handbook is the first English work to give a detailed account of the use of modern diamond apparatus in searching for mineral deposits. The work contains much information of a practical character, including particulars of the cost of apparatus and of working."—*Nature*.

FIELD TESTING FOR GOLD AND SILVER.

A Practical Manual for Prospectors and Miners. By W. H. MERRITT, M.N.E.Inst.M.E., A.R.S.M., &c. With Photographic Plates and other Illustrations. Fcap. 8vo, leather. [Just Published. Net 5/-]

"As an instructor of prospectors classes Mr. Merritt has the advantage of knowing exactly the information likely to be most valuable to the miner in the field. The contents cover all the details of sampling and testing gold and silver ores. The work will be a useful addition to a prospector's kit."—*Mining Journal*.

"It gives the gist of Mr. Merritt's experience as a 'teacher of prospectors, and is a book which no prospector could use satisfactorily without having it placed at his disposal."—*Scotsman*.

THE PROSPECTOR'S HANDBOOK.

A Guide for the Prospector and Traveller in Search of Metal-Bearing or other Valuable Minerals. By J. W. ANDERSON, M.A. (Camb.), F.R.G.S., Author of "Fiji and New Caledonia." Eighth Edition, thoroughly Revised and much Enlarged. Small crown 8vo, 3/6 cloth; or, leather, pocket-book form, with tuck. [Just Published. 4/6]

"Will supply a much felt want, especially among Colonists, in whose way are so often thrown many mineralogical specimens the value of which it is difficult to determine."—*Engineer*.

"How to find commercial minerals, and how to identify them when they are found, are the leading points to which attention is directed. The author has managed to pack as much practical detail into his pages as would supply material for a book three times its size."—*Mining Journal*.

THE METALLURGY OF SILVER.

A Practical Treatise on the Amalgamation, Roasting, and Lixiviation of Silver Ores. Including the Assaying, Melting, and Refining of Silver Bullion. By M. EISSLER, Author of "The Metallurgy of Gold," &c. Third Edition. Crown 8vo, cloth **10/6**

"A practical treatise, and a technical work which we are convinced will supply a long felt want amongst practical men, and at the same time be of value to students and others indirectly connected with the industries."—*Miner*

"From first to last the"—*Colliery Guardian*.

"For chemists, practical miners, assayers, and investors alike, we do not know of any work on the subject so handy and yet so comprehensive."—*Glasgow Herald*.

THE METALLURGY OF ARGENTIFEROUS LEAD.

A Practical Treatise on the Smelting of Silver-Lead Ores and the Refining of Lead Bullion. Including Reports on various Smelting Establishments and Descriptions of Modern Smelting Furnaces and Plants in Europe and America. By M. EISSLER, M.E., Author of "The Metallurgy of Gold," &c. Crown 8vo, 400 pp., with 183 Illustrations, cloth **12/6**

" processes, which are fully and extensively treated, embrace all the stages the lead from the various natural states to its issue from the refinery as an article of commerce."—*Practical Engineer*.

"The present volume fully maintains the reputation of the author. Those who wish to obtain a thorough this industry cannot do better than read this volume, and all mining useful hints and suggestions in it."—*Industries*.

METALLIFEROUS MINERALS AND MINING.

By D. C. DAVIES, F.G.S., Mining Engineer, &c., Author of "A Treatise on Slate and Slate Quarrying." Fifth Edition, thoroughly Revised and much Enlarged by his Son, E. HENRY DAVIES, M.E., F.G.S. With about 150 Illustrations. Crown 8vo, cloth **12/6**

"Neither the practical miner nor the general reader, interested in mines, can have a better book for his companion and his guide."—*Mining Journal*.

"We are doing our readers a service in calling their attention to this valuable work."—*Mining World*.

"As a history of the present state of mining throughout the world this book has a real value, and it supplies an actual want."—*Athenaeum*.

MACHINERY FOR METALLIFEROUS MINES.

A Practical Treatise for Mining Engineers, Metallurgists and Managers of Mines. By E. HENRY DAVIES, M.E., F.G.S. Crown 8vo, 580 pp., with upwards of 300 Illustrations, cloth **12/6**

"Mr. Davies, in this handsome volume, has done the advanced student and the manager of mines good service. Almost every kind of machinery in actual use is carefully described, and the woodcuts and plates are good."—*Athenaeum*.

"From cover to cover the work exhibits all the same characteristics which excite the confidence and attract the attention of the student as he peruses the first page. The work may safely be recommended. By its publication the literature connected with the industry will be enriched, and the reputation of its author enhanced."—*Mining Journal*.

EARTHY AND OTHER MINERALS AND MINING.

By D. C. DAVIES, F.G.S., Author of "Metalliferous Minerals," &c. Third Edition, Revised and Enlarged, by his Son, E. HENRY DAVIES, M.E., F.G.S. With about 100 Illustrations. Crown 8vo, cloth **12/6**

"We do not remember to have met with any English work on mining matters that contains the same amount of information packed in equally convenient form."—*Academy*.

"We should be inclined to rank it as among the very best of the handy technical and trades manuals which have recently appeared."—*British Quarterly Review*.

BRITISH MINING.

A Treatise on the History, Discovery, Practical Development, and Future Prospects of Metalliferous Mines in the United Kingdom. By ROBERT HUNT, F.R.S., late Keeper of Mining Records. Upwards of 950 pp., with 230 Illustrations. Second Edition, Revised. Super-royal 8vo, cloth **£2 2s.**

"The book is a treasure-house of statistical information on mining subjects, and we know of no other work embodying so great a mass of matter of this kind. Were this the only merit of Mr. Hunt's volume it would be sufficient to render it indispensable in the library of everyone interested in the development of the mining and metallurgical industries of this country."—*Athenaeum*.

"A mass of information not elsewhere available, and of the greatest value to those who may be interested in our great mineral industries."—*Engineer*.

POCKET-BOOK FOR MINERS & METALLURGISTS.

Comprising Rules, Formulae, Tables, and Notes, for Use in Field and Office Work. By F. DANVERS POWER, F.G.S., M.E. Second Edition, Corrected. Fcap. 8vo, leather. [Just Published. 9/-

"This excellent book is an admirable example of its kind, and ought to find a large sale amongst English-speaking prospectors and mining engineers."—*Engineering*.

THE MINER'S HANDBOOK.

A Handy Book of Reference on the subjects of Mineral Deposits, Mining Operations, Ore Dressing, &c. For the Use of Students and others interested in Mining matters. Compiled by JOHN MILNE, F.R.S., Professor of Mining in the Imperial University of Japan. Revised Edition. Fcap. 8vo, leather. 7/6

"Professor Milne's handbook is sure to be received with favour by all connected with mining, and will be extremely popular among students."—*Athenaeum*.

IRON ORES OF GREAT BRITAIN AND IRELAND:

Their Mode of Occurrence, Age and Origin, and the Methods of Searching for and Working them. With a Notice of some of the Iron Ores of Spain. By J. D. KENDALL, F.G.S., Mining Engineer. Crown 8vo, cloth. 16/-

"A very useful volume which cannot fail to be of value to all interested in the iron industry of the country."—*Industries*.

MINE DRAINAGE.

A Complete Practical Treatise on Direct-acting Underground Steam Pumping Machinery. By STEPHEN MICHELL. Second Edition, Re-written and Enlarged, 390 pp. With about 250 Illustrations. Royal 8vo, cloth.

[Just Published Net 25/-

HORIZONTAL PUMPING ENGINES—ROTARY AND NON-ROTARY HORIZONTAL ENGINES—SIMPLE AND COMPOUND STEAM PUMPS—VERTICAL PUMPING ENGINES—ROTARY AND NON-ROTARY VERTICAL ENGINES—SIMPLE AND COMPOUND STEAM PUMPS—TRIPLE-EXPANSION STEAM PUMPS—PULSATING STEAM PUMPS—PUMP VALVES—SINKING PUMPS, &c., &c.

"The author has succeeded in presenting a most valuable and interesting new matter. The book should be in the hands of every one who wishes for information on the subject, inasmuch as the different patterns of steam pumps are clearly described and clearly illustrated, and in addition numerous tables are supplied, in which their sizes, capacity, price, &c., are set forth, hence facilitating immensely the rational selection of a pump to suit any purpose that the reader may desire, or, on the other hand, supplying him with a full knowledge of the pumps that come within the scope of the volume."—*The Engineer*.

THE COLLIERY MANAGER'S HANDBOOK.

A Comprehensive Treatise on the Laying-out and Working of Collieries, Designed as a Book of Reference for Colliery Managers, and for the Use of Coal-Mining Students preparing for First-class Certificates. By CALEB PAMELY, Mining Engineer and Surveyor; Member of the North of England Institute of Mining and Mechanical Engineers; and Member of the South Wales Institute of Mining Engineers. With 700 Plans, Diagrams, and other Illustrations. Fourth Edition, Revised and Enlarged, medium 8vo, over 900 pp., strongly bound. 25/-

GEOLOGY.—SEARCH FOR COAL.—MINERAL LEASES AND OTHER HOLDINGS.—SHAFT SINKING.—FITTING UP THE SHAFT AND SURFACE ARRANGEMENTS.—STEAM BOILERS AND THEIR FITTINGS.—TIMBERING AND WALLING.—NARROW WORK AND METHODS OF WORKING.—UNDERGROUND CONVEYANCE.—DRAINAGE.—THE GASES MET WITH IN MINES; VENTILATION.—ON THE FRICTION OF AIR IN MINES.—THE PRIESTMAN OIL ENGINE; PETROLEUM AND NATURAL GAS.—SURVEYING AND PLANNING.—SAFETY LAMPS AND FIRE-DAMPS; DETECTORS.—SUNDRY AND INCIDENTAL OPERATIONS AND APPLIANCES.—COLLIERY EXPLOSIONS.—MISCELLANEOUS QUESTIONS AND ANSWERS.—Appendix: SUMMARY OF REPORT OF H.M. COMMISSIONERS ON ACCIDENTS IN MINES.

"Mr. Pameley has not only given us a comprehensive reference book of a very high order, suitable to the requirements of mining engineers and colliery managers, but he has also provided mining students with a class-book that is as interesting as it is instructive."—*Colliery Manager*.

"Mr. Pameley's work is eminently suited to the purpose for which it is intended, being clear, lucid, and well arranged, and up-to-date, giving descriptions of the latest machines in every department of mining, and showing very clearly what may go wrong who followed this work."—*Colliery Guardian*.

COLLIERY WORKING AND MANAGEMENT.

Comprising the Duties of a Colliery Manager, the Oversight and Arrangement of Labour and Wages, and the different Systems of Working Coal Seams. By H. F. BULMAN and R. A. S. REDMAYNE. 350 pages, with 28 Plates and other Illustrations, including Underground Photographs. Medium 8vo, cloth

[Just Published. 15/-]

"This is, indeed, an admirable Handbook for Colliery Managers, in fact, it is an indispensable adjunct to a Colliery Manager's education, as well as being a most useful and interesting work on the subject for all who in any way have to do with coal mining. The underground photographs are an attractive feature of the work, being very life-like and necessarily true representations of the scenes they depict."—*Colliery Guardian*.

"Mr. Bulman and Mr. Redmayne, who are both experienced Colliery Managers of great literary ability, have done a valuable service by having supplied an authoritative work dealing with a side of the subject of coal mining which has until now received but scant treatment. The authors elucidate their text by 119 woodcuts and 20 plates, most of the latter being admirable reproductions of photographs taken underground with the aid of the magnesium flash-light. These illustrations are excellent."—*Nature*.

COAL AND COAL MINING.

By the late Sir WARINGTON W. SMYTH, M.A., F.R.S., Chief Inspector of the Mines of the Crown and of the Duchy of Cornwall. Eighth Edition, Revised and Extended by T. FORSTER BROWN, Mining and Civil Engineer, Chief Inspector of the Mines of the Crown and of the Duchy of Cornwall. Crown 8vo, cloth.

[Just Published. 3/6]

"As an outline is given of every known coal-field in this and other countries, as well as of the principal methods of working, the book will doubtless interest a very large number of readers."—*Mining Journal*.

NOTES AND FORMULÆ FOR MINING STUDENTS.

By JOHN HERMAN MERIVALE, M.A., Late Professor of Mining in the Durham College of Science, Newcastle-upon-Tyne. Fourth Edition, Revised and Enlarged, by H. F. BULMAN, A.M.Inst.C.E. Small crown 8vo, cloth.

2/6

"The author has done his work in a creditable manner, and has produced a book that will be of service to students, and those who are practically engaged in mining operations."—*Engineer*.

INFLAMMABLE GAS AND VAPOUR IN THE AIR

(The Detection and Measurement of). By FRANK CLOWES, D.Sc., Lond., F.I.C. With a Chapter on THE DETECTION AND MEASUREMENT OF PETROLEUM VAPOUR by BOVERTON REDWOOD, F.R.S.E. Consulting Adviser to the Corporation of London under the Petroleum Acts. Crown 8vo, cloth Net 5/-

"Professor Clowes has given us a volume on a subject of much industrial importance. Those interested in these matters may be recommended to study this book, which is easy of comprehension and contains many good tables."—*The Engineer*.

COAL & IRON INDUSTRIES OF THE UNITED KINGDOM.

Comprising a Description of the Coal Fields, and of the Principal Seams of Coal, with Returns of their Produce and its Distribution, and Analyses of Special Varieties. Also, an Account of the Occurrence of Iron Ores in Veins or Seams; Analyses of each Variety; and a History of the Rise and Progress of Pig Iron Manufacture. By RICHARD MEADE. 8vo, cloth 28/-

"Of this book we may unreservedly say that it is the best of its class which we have ever met. . . . A book of reference which no one engaged in the iron or coal trades should omit from his library."—*Iron and Coal Trades' Review*.

ASBESTOS AND ASBESTIC.

Their Properties, Occurrence, and Use. By ROBERT H. JONES, F.S.A., Mineralogist, Hon. Mem. Asbestos Club, Black Lake, Canada. With Ten Collotype Plates and other Illustrations. Demy 8vo, cloth.

[Just Published. 16/-]

"An interesting and invaluable work."—*Colliery Guardian*.

GRANITES AND OUR GRANITE INDUSTRIES.

By GEORGE F. HARRIS, F.G.S. With Illustrations. Crown 8vo, cloth 2/6

TRAVERSE TABLES.

For use in Mine Surveying. By WILLIAM LINTERN, C.E. With two Plates. Small crown 8vo, cloth.

[Just Published. Net 3/-]

ELECTRICITY, ELECTRICAL ENGINEERING, ETC.

SUBMARINE TELEGRAPHS.

Their History, Construction and Working. Founded in part on WÜNSCHEN-DORFF's "Traité de Télégraphie Sous Marine," and Compiled from Authoritative and Exclusive Sources. By CHARLES BRIGHT, F.R.S.E. Super royal 8vo, nearly 800 pages, fully illustrated, including a large number of maps and folding plates.

[Just Published. Net £3 3s.]

"There are few, if any, persons more fitted to write a treatise on submarine telegraphy than Mr. Charles Bright. He has done his work admirably, and has written in a way which will appeal as much to the engineer. This admirable volume must for many years to come hold the classic on submarine telegraphy."—*Engineer*.

of information. It makes a book of reference which should be in every engineer's library."—*Nature*.

"Mr. Bright's interestingly written and admirably illustrated book will meet with a welcome reception from cable men."—*Electrician*.

"The Author deals with his subject from all points of view—political as well as scientific—the work will be of interest not only to men of science, but to . . . We can strongly recommend it."—*Athenaeum*.

"The work contains a great store of technical information concerning the making and working of submarine telegraphs. In bringing together the most valuable results relating to the evolution of the telegraph the Author has rendered a service that will be very widely appreciated."—*Morning Post*.

DYNAMO ELECTRIC MACHINERY.

Its Construction, Design, and Operation (Direct Current Machines). By SAMUEL SHELDON, A.M., Ph.D., assisted by H. MASON, B.S. Large crown 8vo, cloth. With 202 Illustrations.

[Just Published. Net 10/6]

THE ELECTRICAL ENGINEER'S POCKET-BOOK.

Consisting of Modern Rules, Formulae, Tables, and Data. By H. R. KEMPE, M.Inst.E.E., A.M.Inst.C.E., Technical Officer, Postal Telegraphs, Author of "A Handbook of Electrical Testing," &c. Second Edition, Thoroughly Revised, with Additions. With numerous Illustrations. Royal 32mo, oblong, leather 5/-

"It is the best book of its kind."—*Electrical Engineer*.

"The Electrical Engineer's Pocket-Book is a good one."—*Electrician*.

"Strongly recommended to those engaged in the electrical industries."—*Electrical Review*.

ELECTRIC LIGHT FITTING.

A Handbook for Working Electrical Engineers, embodying Practical Notes on Installation Management. By J. W. URQUHART, Electrician, Author of "Electric Light," &c. With numerous Illustrations. Third Edition, Revised, with Additions. Crown 8vo, cloth.

[Just Published. 5/-]

"This volume deals with the mechanics of electric lighting, and is addressed to men who are already engaged in the work, or are training for it. The work traverses a great deal of ground, and may be read as a sequel to the author's useful work on 'Electric Light.'"—*Electrician*.

"The book is well worth the perusal of the workman, for whom it is written."—*Electrical Review*.

ELECTRIC LIGHT.

Its Production and Use, Embodying Plain Directions for the Treatment of Dynamo-Electric Machines, Batteries, Accumulators, and Electric Lamps. By J. W. URQUHART, C.E. Sixth Edition, Revised, with Additions. Crown 8vo, cloth.

[Just Published. 7/6]

"The whole ground of electric lighting is more or less covered and explained in a very clear and concise manner."—*Electrical Review*.

"A *vade-mecum* of the salient facts connected with the science of electric lighting."—*Electrician*.

DYNAMO CONSTRUCTION.

A Practical Handbook for the Use of Engineer Constructors and Electricians-in-Charge. Embracing Framework Building, Field Magnet and Armature Winding and Grouping, Compounding, &c. By J. W. URQUHART. Second Edition, Enlarged. With 114 Illustrations. Crown 8vo, cloth.

7/6

"Mr. Urquhart's book is the first one which deals with these matters in such a way that the engineering student can understand them. The book is very readable, and the author leads his readers up to difficult subjects by reasonably simple tests."—*Engineering Review*.

THE MANAGEMENT OF DYNAMOS.

A Handybook of Theory and Practice for the Use of Mechanics, Engineers, Students and others in Charge of Dynamos. By G. W. LUMMIS-PATERSON. Second Edition, Thoroughly Revised and Enlarged. With numerous Illustrations. Crown 8vo, cloth. [Just Published. 4/-]

"An example which deserves to be taken as a model by other authors. The subject is treated in a manner which any intelligent man who is fit to be entrusted with charge of an engine should be able to understand. It is a useful book to all who make, tend or employ electric machinery."—Architect.

THE STANDARD ELECTRICAL DICTIONARY.

A Popular Dictionary of Words and Terms Used in the Practice of Electrical Engineering. Containing upwards of 3,000 Definitions. By T. O'CONOR SLOANE, A.M., Ph.D. Second Edition, with Appendix. Crown 8vo, 690 pp., 390 Illustrations, cloth. [Just Published. 7/6]

"The work has many attractive features in it, and is, beyond doubt, a well put together and useful publication. The amount of ground covered may be gathered from the fact that in the index about 5,000 references will be found."—*Electrical Review*.

ELECTRIC SHIP-LIGHTING.

A Handbook on the Practical Fitting and Running of Ship's Electrical Plant. For the Use of Shipowners and Builders, Marine Electricians, and Sea-going Engineers in Charge. By J. W. URQUHART, C.E. Second Edition. Revised and Extended. With 88 Illustrations, crown 8vo, cloth. [Just Published. 7/6]

"The subject of ship electric lighting is one of vast importance, and Mr. Urquhart is to be highly complimented for placing such a valuable work at the service of marine electricians."—*The Steamship*.

ELECTRIC LIGHT FOR COUNTRY HOUSES.

A Practical Handbook on the Erection and Running of Small Installations, with Particulars of the Cost of Plant and Working. By J. H. KNIGHT. Third Edition, Revised. Crown 8vo, wrapper. [Just Published. 1/-]

"The book contains excellent advice and many practical hints for the help of those who wish to light their own houses."—*Building News*.

ELECTRIC LIGHTING (ELEMENTARY PRINCIPLES OF).

By ALAN A. CAMPBELL SWINTON, M.Inst.C.E., M.Inst.E.E. Fourth Edition, Revised. With Sixteen Illustrations. Crown 8vo, cloth. [Just Published. 1/6]

"Any one who desires a short and thoroughly clear exposition of the elementary principles of electric-lighting cannot do better than read this little work."—*Bradford Observer*.

DYNAMIC ELECTRICITY AND MAGNETISM.

By PHILIP ATKINSON, A.M., Ph.D., Author of "Elements of Static Electricity," &c. Crown 8vo, 417 pp., with 120 Illustrations, cloth. [Just Published. 10/-]

POWER TRANSMITTED BY ELECTRICITY.

And applied by the Electric Motor, including Electric Railway Construction. By P. ATKINSON, A.M., Ph.D. With 94 Illustrations. Crown 8vo, cloth. [Just Published. 7/6]

HOW TO MAKE A DYNAMO.

A Practical Treatise for Amateurs. Containing numerous Illustrations and Detailed Instructions for Constructing a Small Dynamo to Produce the Electric Light. By ALFRED CROFTS. Sixth Edition, Revised and Enlarged. Crown 8vo, cloth. [Just Published. 2/-]

"The instructions given in this unpretentious little book are sufficiently clear and explicit to enable any amateur mechanician possessed of average skill and the usual tools to be found in an amateur's workshop, to build a practical dynamo machine."—*Electrician*.

THE STUDENT'S TEXT-BOOK OF ELECTRICITY.

By H. M. NOAD, F.R.S. Cheaper Edition. 650 pp., with 470 Illustrations. Crown 8vo, cloth. [Just Published. 9/-]

ARCHITECTURE, BUILDING, ETC.

PRACTICAL BUILDING CONSTRUCTION.

A Handbook for Students Preparing for Examinations, and a Book of Reference for Persons Engaged in Building. By JOHN PARNELL ALLEN, Surveyor, Lecturer on Building Construction at the Durham College of Science, Newcastle-on-Tyne. Third Edition, Revised and Enlarged. Medium 8vo, 450 pages, with 1,000 Illustrations, cloth.

[Just Published. 7/6]

"The most complete exposition of building construction we have seen. It contains all that is necessary to prepare students for the various examinations in building construction."—*Building News*.

"The author depends nearly as much on his diagrams as on his type. The pages suggest the hand of a man of experience in building operations—and the volume must be a blessing to many teachers as well as to students."—*The Architect*.

"The work is sure to prove a formidable rival to great and small competitors alike, and bids fair to take a permanent place as a favourite student's text-book. The large number of illustrations deserve particular mention for the great merit they possess for purposes of reference, in exactly corresponding to convenient scales."—*Jour. Inst. Brit. Archts.*

PRACTICAL MASONRY.

A Guide to the Art of Stone Cutting. Comprising the Construction, Setting-out, and Working of Stairs, Circular Work, Arches, Niches, Domes, Pendentives, Vaults, Tracery Windows, &c. For the Use of Students, Masons, and other Workmen. By WILLIAM R. PURCHASE, Building Inspector to the Borough of Hove. Third Edition, with Glossary of Terms. Royal 8vo, 142 pages, with 52 Lithographic Plates, comprising 400 separate Diagrams, cloth.

[Just Published. 7/6]

"Mr. Purchase's 'Practical Masonry' will undoubtedly be found useful to all interested in this important subject, whether theoretically or practically. Most of the examples given are from actual work carried out, the diagrams being carefully drawn. The book is a practical treatise on the subject, commenced as an operative mason, and afterwards as an architectural student and others, as well as to architectural students and others, as well as to addressed."—*Journal of the Royal Institute of British Architects*.

MODERN PLUMBING,

STEAM AND HOT WATER HEATING.

A New Practical Work for the Plumber, the Heating Engineer, the Architect, and the Builder. By J. J. LAWLER, Author of "American Sanitary Plumbing," &c. With 284 Illustrations and Folding Plates. 4to, cloth.

[Just Published. Net 21/-]

HEATING BY HOT WATER.

With Information and Suggestions on the best Methods of Heating Public, Private and Horticultural Buildings. By WALTER JONES. Second Edition. With 96 Illustrations, crown 8vo.

Net 2/6

"We confidently recommend all interested in heating by hot water to secure a copy of this valuable little treatise."—*The Plumber and Decorator*.

CONCRETE: ITS NATURE AND USES.

A Book for Architects, Builders, Contractors, and Clerks of Works. By GEORGE L. SUTCLIFFE, A.R.I.B.A. 350 pages, with Illustrations. Crown 8vo, cloth 7/6

"The author treats a difficult subject in a lucid manner. The manual fills a long-felt gap. It is careful and exhaustive, equally useful as a student's guide and an architect's book of reference."—*Journal of Royal Institute of British Architects*.

LOCKWOOD'S BUILDER'S PRICE BOOK FOR 1901.

A Comprehensive Handbook of the Latest Prices and Data for Builders, Merchants, Importers, and Contractors. Re-constructed, Re-written, and Completely Enlarged. By FRANCIS T. W. MILLER. 800 closely-printed pages, crown 8vo, cloth.

4/-

"This book is a very useful one, and should find a place in every English office connected with the building and engineering professions."—*Industries*. "An excellent book of reference."—*A Architect*.

"In its new and revised form this Price Book is what a work of this kind should be—comprehensive, reliable, well arranged, legible, and well bound."—*British Architect*.

DECORATIVE PART OF CIVIL ARCHITECTURE.

By Sir WILLIAM CHAMBERS, F.R.S. With Portrait, Illustrations, Notes, and an EXAMINATION OF GRECIAN ARCHITECTURE, by JOSEPH GWILT, F.S.A. Revised and Edited by W. H. LEEDS. 66 Plates, 4to, cloth. **21/-**

THE MECHANICS OF ARCHITECTURE.

A Treatise on Applied Mechanics, especially Adapted to the Use of Architects. By E. W. TARN, M.A., Author of "The Science of Building," &c. Second Edition, Enlarged. Illustrated with 125 Diagrams. Crown 8vo, cloth. **7/6**
"The book is a very useful and helpful manual of architectural mechanics."—*Builder*.

A HANDY BOOK OF VILLA ARCHITECTURE.

Being a Series of Designs for Villa Residences in various Styles. With Outline Specifications and Estimates. By C. WICKES, Architect, Author of "The Spires and Towers of England," &c. 6x Plates, 4to, half-morocco, gilt edges. **£1 11s. 6d.**

"The whole of the designs bear evidence of their being the work of an artistic architect, and they will prove very valuable and suggestive."—*Building News*.

THE ARCHITECT'S GUIDE.

Being a Text-book of Useful Information for Architects, Engineers, Surveyors, Contractors, Clerks of Works, &c., &c. By F. ROGERS. Crown 8vo, cloth **3/6**

ARCHITECTURAL PERSPECTIVE.

The whole Course and Operations of the Draughtsman in Drawing a Large House in Linear Perspective. Illustrated by 43 Folding Plates. By F. O. FERGUSON. Second Edition, Enlarged. 8vo, boards. **3/6**

"It is the most intelligible of the treatises on this ill-treated subject that I have met with."—E. INGRESS BELL, Esq., in the R.I.B.A. Journal.

PRACTICAL RULES ON DRAWING.

For the Operative Builder and Young Student in Architecture. By GEORGE PYNE. 14 Plates, 4to, boards. **7/6**

MEASURING AND VALUING ARTIFICES' WORK

(The Student's Guide to the Practice of). Containing Directions for taking Dimensions, Abstracting the same, and bringing the Quantities into Bill, with Tables of Constants for Valuation of Labour, and for the Calculation of Areas and Solidities. Originally edited by E. DOBSON, Architect. With Additions by E. W. TARN, M.A. Seventh Edition, Revised. With 8 Plates and 63 Woodcuts. Crown 8vo, cloth.

[Just Published. **7/6**

"This edition will be found the most complete treatise on the principles of measuring and valuing artificers' work that has yet been published."—*Building News*.

TECHNICAL GUIDE, MEASURER, AND ESTIMATOR.

For Builders and Surveyors. Containing Technical Directions for Measuring Work in all the Building Trades, Complete Specifications for Houses, Roads, and Drains, and an Easy Method of Estimating the parts of a Building collectively. By A. C. BEATON. Ninth Edition. Waistcoat-pocket size, gilt edges. **1/6**

"No builder, architect, surveyor, or valuer should be without his 'Beaton!'"—*Building News*.

SPECIFICATIONS

FOR PRACTICAL ARCHITECTURE.

A Guide to the Architect, Engineer, Surveyor, and Builder. With an Essay on the Structure and Science of Modern Buildings. Upon the Basis of the Work by ALFRED BARTHOLOMEW, thoroughly Revised, Corrected, and greatly added to by FREDERICK ROGERS, Architect. Third Edition, Revised. 8vo, cloth **15/-**

"The work is too well known to need any recommendation from us. It is one of the books with which every young architect must be equipped."—*Architect*.

THE HOUSE-OWNER'S ESTIMATOR.

Or, What will it Cost to Build, Alter, or Repair? A Price Book for Unprofessional People, as well as the Architectural Surveyor and Builder. By J. D. SIMON. Edited by F. T. W. MILLER, A.R.I.B.A. Fifth Edition, carefully Revised. Crown 8vo, cloth.

[Just Published. Net **3/6**

"In two years it will repay its cost a hundred times over."—*Field*.

SANITATION AND WATER SUPPLY.

THE PURIFICATION OF SEWAGE.

Being a Brief Account of the Scientific Principles of Sewage Purification, and their Practical Application. By SIDNEY BARWISE, M.D. (Lond.), M.R.C.S., D.P.H. (Camb.), Fellow of the Sanitary Institute, Medical Officer of Health to the Derbyshire County Council. Crown 8vo, cloth. [Just Published. 5/- "we adopt to purify our sewage?" This question has rarely been treated from one book. This volume teems with practical hints, which show the intimate details of his subject."—*The Engineer*.]

WATER AND ITS PURIFICATION.

A Handbook for the Use of Local Authorities, Sanitary Officers, and others interested in Water Supply. By S. RIDEAL, D.Sc., Lond., F.I.C. Crown 8vo 7/6 "Dr. Rideal's book is both interesting and accurate, and contains a most useful résumé of the latest knowledge upon the subject of which it treats."—*The Engineer*.

RURAL WATER SUPPLY.

A Practical Handbook on the Supply of Water and Construction of Waterworks for Small Country Districts. By ALLAN GREENWELL, A.M.I.C.E., and W. T. CURRY, A.M.I.C.E. Revised Edition. Crown 8vo, cloth 5/- "We conscientiously recommend it as a very useful book for those concerned in obtaining water for small districts, giving a great deal of practical information in a small compass."—*Builder*.

THE WATER SUPPLY OF CITIES AND TOWNS.

By WILLIAM HUMBER, A.M.Inst.C.E., and M.Inst.M.E. Imp. 4to, half-bound morocco. (See page 11) [Net £6 6s.]

THE WATER SUPPLY OF TOWNS

AND THE CONSTRUCTION OF WATER-WORKS.

By Professor W. K. BURTON, A.M.Inst.C.E. Second Edition, Revised and Extended. Royal 8vo, cloth. (See page 10) £1 5s.

WATER ENGINEERING.

A Practical Treatise on the Measurement, Storage, Conveyance, and Utilisation of Water for the Supply of Towns. By C. SLAGG, A.M.Inst.C.E. 7/6

SANITARY WORK IN SMALL TOWNS AND VILLAGES.

By CHARLES SLAGG, A.M.Inst.C.E. Crown 8vo, cloth 3/-

SANITARY ARRANGEMENT OF DWELLING HOUSES.

By A. J. WALLIS-TAYLER, A.M.Inst.C.E. Crown 8vo, cloth 2/6

MODERN PLUMBING,

STEAM AND HOT WATER HEATING.

A New Practical Work for the Plumber, the Heating Engineer, the Architect, and the Builder. By J. J. LAWLER, Author of "American Sanitary Plumbing," &c. With 284 Illustrations and Folding Plates. 4to, cloth.

[Just Published (see page 25). Net 21/-]

PLUMBING.

A Text-Book to the Practice of the Art or Craft of the Plumber. By W. P. BUCHAN. Eighth Edition, Enlarged, with 500 Illustrations. Crown 8vo 3/6

VENTILATION.

A Text-Book to the Practice of the Art of Ventilating Buildings. By W. P. BUCHAN, R.P. Crown 8vo, cloth 3/6

THE HEALTH OFFICER'S POCKET-BOOK.

A Guide to Sanitary Practice and Law. For Medical Officers of Health, Sanitary Inspectors, Members of Sanitary Authorities, &c. By EDWARD F. WILLOUGHBY, M.D. (Lond.), &c. Fcap. 8vo, cloth 7/6

"A mine of condensed information of a pertinent and useful kind on the various subjects of which it treats. The different subjects are succinctly but fully and scientifically dealt with."—*The Lancet*.

CARPENTRY, TIMBER, ETC.

THE ELEMENTARY PRINCIPLES OF CARPENTRY.

A Treatise on the Pressure and Equilibrium of Timber Framing, the Resistance of Timber, and the Construction of Floors, Arches, Bridges, Roofs, Uniting Iron and Stone with Timber, &c. To which is added an Essay on the Nature and Properties of Timber, &c., with Descriptions of the kinds of Wood used in Building; also numerous Tables of the Scantlings of Timber for different purposes, the Specific Gravities of Materials, &c. By THOMAS TREDGOLD, C.E. With an Appendix of Specimens of Various Roofs of Iron and Stone, Illustrated. Seventh Edition, thoroughly Revised and considerably Enlarged by E. WYNDHAM TARN, M.A., Author of "The Science of Building," &c. With 61 Plates, Portrait of the Author, and several Woodcuts. In One large Vol., 4to, cloth.

£1 5s.

"Ought to be in every architect's and every builder's library."—*Builder*.

"A work whose monumental excellence must commend it wherever skilful carpentry is concerned. The author's principles are more confirmed than impaired by time. The additional plates are of great intrinsic value."—*Building News*.

WOODWORKING MACHINERY.

Its Rise, Progress, and Construction. With Hints on the Management of Saw Mills and the Economical Conversion of Timber. By M. POWIS BALE, A.M.Inst.C.E., M.I.M.E. Second Edition, Revised, with large Additions, large crown 8vo, 440 pp., cloth. **9/-**

"Mr. Bale is evidently an expert on the subject, and he has collected so much information that his book is of great service to students and others engaged in the conversion of timber."—*Architect*.
"A very valuable addition to the literature of wood-working machinery we have seen. The author is a man of great knowledge and experience."—*News*.

SAW MILLS.

Their Arrangement and Management, and the Economical Conversion of Timber. (A Companion Volume to "Woodworking Machinery.") By M. POWIS BALE, A.M.Inst.C.E. Second Edition, Revised. Crown 8vo, cloth.

[Just Published.] **10/6**

"The administration of a large sawing establishment is discussed, and the subject examined from a financial standpoint. Hence the size, shape, origin, and disposition of saw-mills and the like are gone into in detail, and the course of the timber is traced from its reception to its delivery in its converted state. We could not desire a more complete or practical treatise."—*Builder*.

THE CARPENTER'S GUIDE.

Or, Book of Lines for Carpenters; comprising all the Elementary Principles essential for acquiring a knowledge of Carpentry. Founded on the late PETER NICHOLSON's standard work. A New Edition, Revised by ARTHUR ASHPITEL, F.S.A. Together with Practical Rules on Drawing, by GEORGE PYNE. With 74 Plates, 4to, cloth.

£1 1s.

A PRACTICAL TREATISE ON HANDRAILING.

Showing New and Simple Methods for Finding the Pitch of the Plank, Drawing the Moulds, Bevelling, Jointing-up, and Squaring the Wreath. By GEORGE COLLINGS. Second Edition, Revised and Enlarged, to which is added A TREATISE ON STAIR-BUILDING. With Plates and Diagrams. 12mo, cloth **2/6**

"Will be found of practical utility in the execution of this difficult branch of joinery."—*Builder*.
"Aines; every difficult phase of this somewhat intricate branch of joinery is elucidated by the aid of plates and explanatory text-pieces."—*Furniture Gazette*.

CIRCULAR WORK IN CARPENTRY AND JOINERY.

A Practical Treatise on Circular Work of Single and Double Curvature. By GEORGE COLLINGS. With Diagrams. Third Edition, 12mo, cloth. **2/6**

"An excellent example of what a book of this kind should be. Cheap in price, clear in definition, and practical in the examples selected."—*Builder*.

THE CABINET-MAKER'S GUIDE

TO THE CONSTRUCTION OF CABINET WORK.

Including Veneering, Marquetry, Buhlwork, Mosaic, Inlaying, &c. By RICHARD BITMEAD. Illustrated with Plans, Sections, and Working Drawings. Crown 8vo, cloth.

[Just Published.] **3/6**

HANDRAILING COMPLETE IN EIGHT LESSONS.

On the Square-Cut System. By J. S. GOLDSHORPE, Teacher of Geometry and Building Construction at the Halifax Mechanic's Institute. With Eight Plates and over 150 Practical Exercises. 4to, cloth **3/6**
 "Likely to be of considerable value to joiners and others who take a pride in good work. The arrangement of the book is excellent. We heartily commend it to teachers and students."—*Timber Trades Journal*.

TIMBER MERCHANT'S & BUILDER'S COMPANION.

Containing New and Copious Tables of the Reduced Weight and Measurement of Deals and Battens, of all sizes, and other useful Tables for the use of Timber Merchants and Builders. By WILLIAM DOWSING. Fourth Edition, Revised and Corrected. Crown 8vo, cloth **3/-**

"We are glad to see a fourth edition of these admirable tables, which for correctness and simplicity of arrangement leave nothing to be desired."—*Timber Trades Journal*.

THE PRACTICAL TIMBER MERCHANT.

Being a Guide for the use of Building Contractors, Surveyors, Builders, &c., comprising useful Tables for all purposes connected with the Timber Trade, Marks of Wood, Essay on the Strength of Timber, Remarks on the Growth of Timber, &c. By W. RICHARDSON. Second Edition. Fcap. 8vo, cloth **3/6**

"This handy manual contains much valuable information for the use of timber merchants, builders, foresters, and all others connected with the growth, sale, and manufacture of timber."—*Journal of Forestry*.

PACKING-CASE TABLES.

Showing the number of Superficial Feet in Boxes or Packing-Cases, from six inches square and upwards. By W. RICHARDSON, Timber Broker. Third Edition. Oblong 4to, cloth **3/6**

"Invaluable labour-saving tables."—*Ironmonger*.

"Will save much labour and calculation."—*Grocer*.

GUIDE TO SUPERFICIAL MEASUREMENT.

Tables calculated from 1 to 200 inches in length, by 1 to 108 inches in breadth. For the use of Architects, Surveyors, Engineers, Timber Merchants, Builders, &c. By JAMES HAWKINS. Fourth Edition. Fcap., cloth **3/6**

"These tables will be found of great assistance to all who require to make calculations in superficial measurement."—*English Mechanic*.

PRACTICAL FORESTRY.

And its Bearing on the Improvement of Estates. By CHARLES E. CURTIS, F.S.I., Professor of Forestry, Field Engineering, and General Estate Management, at the College of Agriculture, Downton. Second Edition, Revised. Crown 8vo, cloth **[Just Published. 3/6]**

PREFATORY REMARKS.—OBJECTS OF PLANTING.—CHOICE OF A FORESTER.—CHOICE OF SOIL AND SITE.—LAYING OUT OF LAND FOR PLANTATIONS.—PREPARATION OF THE GROUND FOR PLANTING.—DRAINAGE.—PLANTING.—DISTANCES AND DISTRIBUTION OF TREES IN PLANTATIONS.—TREES AND GROUND GAME.—ATTENTION AFTER PLANTING.—THINNING OF PLANTATIONS.—PRUNING OF FOREST TREES.—REALIZATION.—METHODS OF SALE.—MEASUREMENT OF TIMBER.—MEASUREMENT AND VALUATION OF LARGE PLANTATIONS.—FIRE LINKS.—COST OF PLANTING.

"Mr. Curtis has in the course of a series of short pithy chapters afforded much information of a useful and practical character on the planting and subsequent treatment of trees."—*Illustrated Carpenter and Builder*.

THE ELEMENTS OF FORESTRY.

Designed to afford Information concerning the Planting and Care of Forest Trees for Ornament or Profit, with suggestions upon the Creation and Care of Woodlands. By F. B. HOUGH. Large crown 8vo. cloth **10/-**

TIMBER IMPORTER'S, TIMBER MERCHANT'S, AND BUILDER'S STANDARD GUIDE.

By RICHARD E. GRANDY. Comprising:—An Analysis of Deal Standards, Home and Foreign, with Comparative Values and Tabular Arrangements for fixing Net Landed Cost on Baltic and North American Deals, including all intermediate Expenses, Freight, Insurance, &c. &c.; together with copious Information for the Retailer and Builder. Third Edition, Revised. 12mo, cloth **2/-**

"Everything it pretends to be: built up gradually, it leads one from a forest to a treenail, and throws in, as a make-weight, a host of material concerning bricks, columns, cisterns, &c."—*English Mechanic*.

DECORATIVE ARTS, ETC.

SCHOOL OF PAINTING FOR THE IMITATION OF WOODS AND MARBLES.

As Taught and Practised by A. R. VAN DER BURG and P. VAN DER BURG, Directors of the Rotterdam Painting Institution. Royal folio, 18 $\frac{1}{2}$ by 12 $\frac{1}{2}$ in., Illustrated with 24 full-size Coloured Plates; also 12 plain Plates, comprising 154 Figures. Third Edition, cloth. [Just Published. £1 11s. 6d.]

LIST OF PLATES.

1. VARIOUS TOOLS REQUIRED FOR WOOD PAINTING.—2, 3. WALNUT; PRELIMINARY STAGES OF GRAINING AND FINISHED SPECIMEN.—4. TOOLS USED FOR MARBLE PAINTING AND METHOD OF MANIPULATION.—5, 6. ST. REMI MARBLE; EARLIER OPERATIONS AND FINISHED SPECIMEN.—7. METHODS OF SKETCHING DIFFERENT GRAINS, KNOTS, &c.—8, 9. ASH; PRELIMINARY STAGES AND FINISHED SPECIMEN.—10. METHODS OF SKETCHING MARBLE GRAINS.—11, 12. BRECHE MARBLE; PRELIMINARY STAGES OF WORKING AND FINISHED SPECIMEN.—13. MAPLE; METHODS OF PRODUCING THE DIFFERENT GRAINS.—14, 15. BIRD'S-EYE MAPLE; PRELIMINARY STAGES AND FINISHED SPECIMEN.—16. METHODS OF SKETCHING THE DIFFERENT SPECIES OF WHITE MARBLE.—17, 18. WHITE MARBLE; PRELIMINARY STAGES OF PROCESS AND FINISHED SPECIMEN.—19. MAHOGANY; SPECIMEN OF VARIOUS GRAINS AND METHODS OF MANIPULATION.—20, 21. MAHOGANY; EARLIER STAGES AND FINISHED SPECIMEN.—22, 23, 24. SIENNA MARBLE; VARIETIES OF GRAIN, PRELIMINARY STAGES AND FINISHED SPECIMEN.—25, 26, 27. JUNIPER WOOD; METHODS OF PRODUCING GRAIN, &c.; PRELIMINARY STAGES AND FINISHED SPECIMEN.—28, 29, 30. VERT DE MER MARBLE; VARIETIES OF GRAIN AND METHODS OF WORKING, UNFINISHED AND FINISHED SPECIMENS.—31, 32, 33. OAK; VARIETIES OF GRAIN, TOOLS EMPLOYED AND METHODS OF MANIPULATION, PRELIMINARY STAGES AND FINISHED SPECIMEN.—34, 35, 36. WAULSORT MARBLE; VARIETIES OF GRAIN, UNFINISHED AND FINISHED SPECIMENS.

"Those who desire to attain skill in the art of painting woods and marbles will find advantage in consulting this book. . . . Some of the Working Men's Clubs should give their young men the opportunity to study it."—*Builder*.

"A comprehensive guide to the art. The explanations of the processes, the manipulation and management of the colours, and the beautifully executed plates will not be the least valuable to the student who aims at making his work a faithful transcript of nature."—*Building News*.

"Students and novices are fortunate who are able to become the possessors of so noble a work."—*The Architect*.

ELEMENTARY DECORATION.

A Guide to the Simpler Forms of Everyday Art. Together with PRACTICAL HOUSE DECORATION. By JAMES W. FACEY. With numerous Illustrations. In One Vol., strongly half-bound

5/-

HOUSE-PAINTING, GRAINING, MARBLING, AND SIGN WRITING,

A Practical Manual of. By ELLIS A. DAVIDSON. Eighth Edition. With Coloured Plates and Wood Engravings. Crown 8vo, cloth

6/-

"A mass of information, of use to the amateur and of value to the practical man."—*English Mechanic*.

THE DECORATOR'S ASSISTANT.

A Modern Guide for Decorative Artists and Amateurs, Painters, Writers, Gilders, &c. Containing upwards of 600 Receipts, Rules and Instructions; with a variety of Information for General Work connected with every Class of Interior and Exterior Decorations, &c. Seventh Edition. 152 pp., crown 8vo, in wrapper.

1/-

"Full of receipts of value to decorators, painters, gilders, &c. The book contains the gist of larger treatises on colour and technical processes. It would be difficult to meet with a work so full of varied information on the painter's art."—*Building News*.

MARBLE DECORATION

And the Terminology of British and Foreign Marbles. A Handbook for Students. By GEORGE H. BLAGROVE, Author of "Shoring and its Application," &c. With 28 Illustrations. Crown 8vo, cloth

3/6

"This most useful and much wanted handbook should be in the hands of every architect and builder."—*Building World*.

"A carefully and usefully written treatise; the work is essentially practical."—*Scotsman*.

DELAMOTTE'S WORKS ON ILLUMINATION AND ALPHABETS.

ORNAMENTAL ALPHABETS, ANCIENT & MEDIÆVAL.

From the Eighth Century, with Numerals; including Gothic, Church-Text, large and small, German, Italian, Arabesque, Initials for Illumination, Monograms, Crosses, &c. &c., for the use of Architectural and Engineering Draughtsmen, Missal Painters, Masons, Decorative Painters, Lithographers, Engravers, Carvers, &c. &c. Collected and Engraved by F. DELAMOTTE, and Printed in Colours. New and Cheaper Edition. Royal 8vo, oblong, ornamental boards **2/6**

"For those who insert enamelled sentences round gilded chalices, who blazon shop legends over shop-doors, who letter church walls with pithy sentences from the Decalogue, this book will be useful."—*Athenæum*.

MODERN ALPHABETS, PLAIN AND ORNAMENTAL.

Including German, Old English, Saxon, Italic, Perspective, Greek, Hebrew, Court Hand, Engrossing, Tuscan, Riband, Gothic, Rustic, and Arabesque; with several Original Designs, and an analysis of the Roman and Old English Alphabets, large and small, and Numerals, for the use of Draughtsmen, Surveyors, Masons, Decorative Painters, Lithographers, Engravers, Carvers, &c. Collected and Engraved by F. DELAMOTTE, and printed in Colours. New and Cheaper Edition. Royal 8vo, oblong, ornamental boards **2/6**

"There is comprised in it every possible shape into which the letters of the alphabet and numerals can be formed, and the talent which has been expended in the conception of the various plain and ornamental letters is wonderful."—*Standard*.

MEDIÆVAL ALPHABETS AND INITIALS.

By F. G. DELAMOTTE. Containing 21 Plates and Illuminated Title, printed in Gold and Colours. With an Introduction by J. WILLIS BROOKS. Fourth and Cheaper Edition. Small 4to, ornamental boards **4/-**

"A volume in which the forms of the alphabet are forthrightly displayed in gilding and all the colours of the prism interwoven and interwoven in intricate knotting."—*Evening Standard*.

A PRIMER OF THE ART OF ILLUMINATION.

For the Use of Beginners; with a Rudimentary Treatise on the Art, Practical Directions for its Exercise, and Examples taken from Illuminated MSS., printed in Gold and Colours. By F. DELAMOTTE. New and Cheaper Edition. Small 4to, ornamental boards **6/-**

"The examples of ancient MSS. recommended to the student, which, with much good sense, the author chooses to collect as accessible to all, are selected with judgment and knowledge, as well as taste."—*Athenæum*.

THE EMBROIDERER'S BOOK OF DESIGN.

Containing Initials, Emblems, Crests, Monograms, Ornamental Borders, Ecclesiastical Devices, Mediæval Motives, &c., and National Emblems. Collected by F. DELAMOTTE, and printed in Colours. Oblong royal 8vo, ornamental wrapper **1/6**

"The book will be of great assistance to ladies and young children who are endowed with the art of plying the needle in this most ornamental and useful pretty work."—*East Anglian Times*.

WOOD-CARVING FOR AMATEURS.

With Hints on Design. By A LADY. With Ten Plates. New and Cheaper Edition. Crown 8vo, in emblematic wrapper **2/-**

"The handicraft of the wood-carver, so well as a book can impart it, may be learnt from 'A Lady's publication.'—*Athenæum*.

PAINTING POPULARLY EXPLAINED.

By THOMAS JOHN GULLICK, Painter, and JOHN TIMBS, F.S.A. Including Fresco, Oil, Mosaic, Water Colour, Water-Glass, Tempera, Encaustic, Miniature, Painting on Ivory, Vellum, Pottery, Enamel, Glass, &c. Fifth Edition. Crown 8vo, cloth **5/-**

"* * * Adopted as a Prize book at South Kensington.
"Much may be learned, even by those who fancy they do not require to be taught, from the careful perusal of this unpretending but comprehensive treatise."—*Art Journal*.

NATURAL SCIENCE, ETC.

THE VISIBLE UNIVERSE.

Chapters on the Origin and Construction of the Heavens. By J. E. GORE, F.R.A.S., Author of "Star Groups," &c Illustrated by 6 Stellar Photographs and 12 Plates. Demy 8vo, cloth **16/-**

"A valuable and lucid summary of recent astronomical theory, rendered more valuable and attractive by a series of stellar photographs and other illustrations."—*The Times*.

"In presenting a clear and concise account of the present state of our knowledge, Mr. Gore has made a valuable addition to the literature of the subject."—*Nature*.

"Mr. Gore's 'Visible Universe' is one of the finest works on astronomical science that has recently appeared in our language. In spirit and in method it is scientific from cover to cover, but the style is so clear and attractive that it will be as acceptable and as readable to those who make no scientific pretensions as to those who devote themselves specially to matters astronomical."—*Leeds Mercury*.

STAR GROUPS.

A Student's Guide to the Constellations. By J. ELLARD GORE, F.R.A.S., M.R.I.A., &c., Author of "The Visible Universe," "The Scenery of the Heavens," &c. With 30 Maps. Small 4to, cloth **5/-**

"The volume contains thirty maps showing stars of the sixth magnitude—the usual naked-eye limit—and each is accompanied by a brief commentary, adapted to facilitate recognition and bring to the observer's special interest. The book is well bound in cloth, and is a credit to the 'midnight pomp' of the Heaven's, revealing clearly the order twenty square inches in area, and the colouring varying from ca new.

AN ASTRONOMICAL GLOSSARY.

Or, Dictionary of Terms used in Astronomy. With Tables of Data and Lists of Remarkable and Interesting Celestial Objects. By J. ELLARD GORE, F.R.A.S., Author of "The Visible Universe," &c. Small crown 8vo, cloth **2/6**

"A very useful little work for beginners in astronomy, and not to be despised by more advanced students."—*The Times*.

"A very handy book the utility of which is much increased by its valuable tables of astronomical data."—*Athenaeum*.

THE MICROSCOPE.

Its Construction and Management. Including Technique, Photo-micrography, and the Past and Future of the Microscope. By Dr. HENRI VAN HEURCK. Re-edited and Augmented from the Fourth French Edition, and Translated by WYNNE E. BAXTER, F.G.S. 400 pages, with upwards of 250 Woodcuts, imp. 8vo, cloth **18/-**

"A translation of a well-known work, at once popular and comprehensive."—*Times*.

"The translation is as felicitous as it is accurate."—*Nature*.

ASTRONOMY.

By the late Rev. ROBERT MAIN, M.A., F.R.S. Third Edition, Revised by WILLIAM THYNNE LYNN, B.A., F.R.A.S., formerly of the Royal Observatory, Greenwich. 12mo, cloth **2/-**

"A sound and simple treatise, very carefully edited, and a capital book for beginners."—*Knowledge*. "Accurately brought down to the requirements of the present time by Mr. Lynn."—*Educational Times*.

A MANUAL OF THE MOLLUSCA.

A Treatise on Recent and Fossil Shells. By S. P. WOODWARD, A.L.S., F.G.S. With an Appendix on RECENT AND FOSSIL CONCHOLOGICAL DISCOVERIES, by RALPH TATE, A.L.S., F.G.S. With 23 Plates and upwards of 300 Woodcuts. Reprint of Fourth Edition (1880). Crown 8vo, cloth **7/6**

"A most valuable storehouse of conchological and geological information."—*Science Gossip*.

THE TWIN RECORDS OF CREATION.

Or, Geology and Genesis, their Perfect Harmony and Wonderful Concord. By G. W. V. LE VAUX. 8vo, cloth **5/-**

"A valuable contribution to the evidences of Revelation, and dispels very conclusively the arguments of those who would set God's Works against God's Word. No real difficulty is shirked, and no sophistry is left unexposed."—*The Rock*.

HANDBOOK OF MECHANICS.

By Dr. LARDNER. Enlarged and re-written by BENJAMIN LOEWY, F.R.A.S. 6/-
378 Illustrations. Post 8vo, cloth

"The perspicuity of the original has been retained, and chapters which had become obsolete have been replaced by others of more modern character. The explanations throughout are studiously popular, and care has been taken to show the application of the various branches of physics to the industrial arts, and to the practical business of life."—*Mining Journal*.

HANDBOOK OF HYDROSTATICS & PNEUMATICS.

By Dr. LARDNER. New Edition, Revised and Enlarged by BENJAMIN LOEWY, F.R.A.S. With 236 Illustrations. Post 8vo, cloth 5/-

"For those who desire to attain accurate knowledge of physical science without the profound methods of mathematical investigation, this work is well adapted."—*Chemical News*.

HANDBOOK OF HEAT.

By Dr. LARDNER. Edited and re-written by BENJAMIN LOEWY, F.R.A.S., &c. 6/-
117 Illustrations. Post 8vo, cloth

"...is clear and precise, and conveys instruction without leaving any cloudiness or Engineering.

HANDBOOK OF OPTICS.

By Dr. LARDNER. New Edition. Edited by T. OLVER HARDING, B.A. Lond. With 298 Illustrations. Small 8vo, 448 pages, cloth 5/-

"Written by one of the ablest English scientific writers, beautifully and elaborately illustrated."—*Mechanic's Magazine*.

ELECTRICITY, MAGNETISM AND ACOUSTICS.

By Dr. LARDNER. Edited by GEO. CAREY FOSTER, B.A., F.C.S. With 400 Illustrations. Small 8vo, cloth 5/-

"The book could not have been entrusted to anyone better calculated to preserve the terse and lucid style of Lardner, while correcting his errors and bringing up his work to the present state of scientific knowledge."—*Popular Science Review*.

HANDBOOK OF ASTRONOMY.

By Dr. LARDNER. Fourth Edition. Revised and Edited by EDWIN DUNKIN, F.R.A.S., Royal Observatory, Greenwich. With 38 Plates and upwards of 100 Woodcuts. 8vo, cloth 9/6

"Probably no other book contains the same amount of information in so compendious and well arranged a form—certainly none at the price at which this is offered to the public."—*Athenaeum*.

"We can do no other than pronounce this work a most valuable manual of astronomy, and we strongly recommend it to all who wish to acquire a general—but at the same time correct—acquaintance with this sublime science."—*Quarterly Journal of Science*.

MUSEUM OF SCIENCE AND ART.

Edited by Dr. LARDNER. With upwards of 1,200 Engravings on Wood. In Six Double Volumes, 1/- in a new and elegant cloth binding; or handsomely bound in half-morocco £1 11s. 6d.

"A cheap and interesting collection of facts informing and attracting. The papers combine subjects of importance and great scientific knowledge, considerable didactic powers, and a popular style of treatment."—*Spectator*.

Separate books formed from the above.

Common Things Explained. 5s.	Steam and its Uses. 2s. cloth.
The Microscope. 2s. cloth.	Popular Astronomy. 4s. 6d. cloth.
Popular Geology. 2s. 6d. cloth.	The Bee and White Ants. 2s. cloth.
Popular Physics. 2s. 6d. cloth.	The Electric Telegraph. 1s. 6d.

NATURAL PHILOSOPHY FOR SCHOOLS.

By Dr. LARDNER. Fcap. 8vo 3/6

"A very convenient class-book for junior students in private schools."—*British Quarterly Review*.

ANIMAL PHYSIOLOGY FOR SCHOOLS.

By Dr. LARDNER. Fcap. 8vo 3/6

"Clearly written, well arranged, and excellently illustrated."—*Gardener's Chronicle*.

THE ELECTRIC TELEGRAPH.

By Dr. LARDNER. Revised by E. B. BRIGHT, F.R.A.S. Fcap. 8vo, cloth. 2/8

"One of the most readable books extant on the Electric Telegraph."—*English Mechanic*

CHEMICAL MANUFACTURES, CHEMISTRY, ETC.

THE GAS ENGINEER'S POCKET BOOK.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas and the Construction of Gas Works. By H. O'CONNOR, A.M.Inst.C.E. 450 pages, crown 8vo, fully Illustrated, leather.

[Just Published. 10/6

"The book contains a vast amount of information. The author goes consecutively through the engineering details and practical methods involved in each of the different processes or parts of a gas-works. He has certainly succeeded in making a compilation of hard matters of fact absolutely interesting to read."—*Gas World*.

"A useful work of reference for all interested in lighting or heating by gas, while the analyses of the various be of value to the technical chemist. All matter in any way connected with use of gas is dealt with. The book has evidently been carefully compiled, and certainly constitutes a useful addition to gas literature."—*Builder*.

"The volume contains a great quantity of specialised information, compiled, we believe, from trustworthy sources, which should make it of considerable value to those for whom it is specifically produced."—*Engineer*.

LIGHTING BY ACETYLENE

Generators, Burners and Electric Furnaces. By WILLIAM E. GIBBS, M.E. With Sixty-six Illustrations. Crown 8vo, cloth.

[Just Published. 7/6

ENGINEERING CHEMISTRY.

A Practical Treatise for the Use of Analytical Chemists, Engineers, Iron Masters, Iron Founders, Students and others. Comprising Methods of Analysis and Valuation of the Principal Materials used in Engineering Work, with numerous Analyses, Examples and Suggestions. By H. JOSHUA PHILLIPS, F.I.C., F.C.S. Second Edition, Revised and Enlarged. Crown 8vo, 400 pages, with Illustrations, cloth.

10/6

"In this work the author has rendered no small service to a numerous body of practical men. The analytical methods may be turned to most advantage, being as accurate as the day's best required of engineering chemists permits."—*Chemical News*.

"The book is full of good things. As a handbook of technical analysis, it is very welcome."—*Builder*.

"The analytical methods given are, as a whole, such as are likely to give rapid and trustworthy results in experienced hands. . . . There is much excellent descriptive matter in the work, the chapter on 'Oils and Lubrication' being specially noticeable in this respect."—*Engineer*.

NITRO-EXPLOSIVES.

A Practical Treatise concerning the Properties, Manufacture, and Analysis of Nitrated Substances, including the Fulminates, Smokeless Powders and Celluloid. By P. GERALD SANFORD, F.I.C., Consulting Chemist to the Cotton Powder Company, Limited, &c. With Illustrations. Crown 8vo, cloth.

[Just Published. 9/-

"One of the very few text-books in which can be found just what is wanted. Mr. Sanford goes steadily through the whole list of explosives commonly used, he names any given explosive and tells us of what it is composed and how it is manufactured. The book is excellent throughout."—*The Engineer*.

A HANDBOOK ON MODERN EXPLOSIVES.

A Practical Treatise on the Manufacture and Use of Dynamite, Gun-Cotton, Nitro-Glycerine, and other Explosive Compounds, including Collodion-Cotton. With Chapters on Explosives in Practical Application. By M. EISLER, M.E. Second Edition, Enlarged. Crown 8vo, cloth.

[Just Published. 12/6

"A veritable mine of information on the subject of explosives employed for military, mining and blasting purposes."—*Army and Navy Gazette*.

DANGEROUS GOODS.

Their Sources and Properties, Modes of Storage and Transport. With Notes and Comments on Accidents arising therefrom. A Guide for the Use of Government and Railway Officials, Steamship Owners, &c. By H. JOSHUA PHILLIPS, F.I.C., F.C.S. Crown 8vo, 374 pages, cloth

9/-

"Merits a wide circulation and an intelligent, appreciative study."—*Chemical News*.

A MANUAL OF THE ALKALI TRADE.

Including the Manufacture of Sulphuric Acid, Sulphate of Soda, and Bleaching Powder. By JOHN LOMAS, Alkali Manufacturer. With 232 Illustrations and Working Drawings. Second Edition, with Additions. Super-royal 8vo, cloth.

£1 10s.

"We find not merely a sound and luminous explanation of the chemical principles of the trade, but a notice of numerous matters which have a most important bearing on the successful conduct of alkali works, but which are generally overlooked by even experienced technological authors."—*Chemical Review*.

THE BLOWPIPE IN CHEMISTRY, MINERALOGY, Etc.

Containing all known Methods of Anhydrous Analysis, many Working Examples, and Instructions for Making Apparatus. By Lieut.-Colonel W. A. ROSS, R.A., F.G.S. Second Edition, Enlarged. Crown 8vo, cloth **5/-**

"The student who goes conscientiously through the course of experimentation here laid down will gain a better insight into inorganic chemistry and mineralogy than if he had 'got up' any of the best text-books of the day, and passed any number of examinations in their contents."—*Chemical News*.

THE MANUAL OF COLOURS AND DYE-WARES.

Their Properties, Applications, Valuations, Impurities, and Sophistications. For the Use of Dyers, Printers, Drysalters, Brokers, &c. By J. W. SLATER. Second Edition, Revised and greatly Enlarged. Crown 8vo, cloth **7/6**

"There is no other work which covers precisely the same ground. To students preparing for examinations in dyeing and printing it will prove exceedingly useful."—*Chemical News*.

A HANDYBOOK FOR BREWERS.

Being a Practical Guide to the Art of Brewing and Malting. Embracing the Conclusions of Modern Research which bear upon the Practice of Brewing. By HERBERT EDWARDS WRIGHT, M.A. Second Edition, Enlarged. Crown 8vo, 530 pp., cloth **12/6**

"May be consulted with advantage by the student who is preparing himself for examinational tests, while the scientific brewer will find in it a *résumé* of all the most important discoveries of modern times. The work is written throughout in a clear and concise manner, and the author takes great care to discriminate between vague theories and well-established facts."—*Brewers' Journal*.

"We have great pleasure in recommending this Handybook, as I have no hesitation in saying that it is one of the best. . . . with all its ye . . . been written on the subject of beer-brewing in this country, it should have a place on the shelves of every brewer's library."—*Brewers' Circular*.

"Although the requirements of the student are naturally considered, an acquaintance of half-an-hour's duration will impress the practical brewer with the sense of having found a trustworthy guide and practical counsellor in the brewhouse."—*Chemical Trade Journal*.

FUELS: SOLID, LIQUID, AND GASEOUS.

Their Analysis and Valuation. For the Use of Chemists and Engineers. By H. J. PHILLIPS, F.C.S., Formerly Analytical and Consulting Chemist to the Great Eastern Railway. Third Edition, Revised and Enlarged. Crown 8vo, cloth **2/-**

"Ought to have its place in the laboratory of every metallurgical establishment, and wherever fuel is used on a large scale."—*Chemical News*.

THE ARTISTS' MANUAL OF PIGMENTS.

Showing their Composition, Conditions of Permanency, Non-Permanency, and Adulterations, &c., with Tests of Purity. By H. C. STANDAGE. Third Edition, crown 8vo, cloth **2/6**

"This work is indeed *multum-in-poco*, and we can, with good conscience, recommend it to all who come in contact with pigments, whether as makers, dealers, or users."—*Chemical Review*.

A POCKET-BOOK OF MENSURATION & GAUGING.

Containing Tables, Rules, and Memoranda for Revenue Officers, Brewers, Spirit Merchants, &c. By J. B. MANT (Inland Revenue). Second Edition, Revised, 18mo, leather **4/-**

"Should be in the hands of every practical brewer."—*Brewers' Journal*.

INDUSTRIAL ARTS, TRADES AND MANUFACTURES.

TEA MACHINERY AND TEA FACTORIES.

A Descriptive Treatise on the Machinery and Apparatus required in the Cultivation of the Tea Plant and the Preparation of Tea for the Market. By A. J. WALLIS-TAYLER, A.M.Inst.C.E. Medium 8vo, 468 pp. With 218 Illustrations.

[Just Published. Net 25/-]

SUMMARY OF CONTENTS.

MECHANICAL CULTIVATION OR TILLAGE OF THE SOIL.—PLUCKING OR GATHERING THE LEAF.—TEA FACTORIES.—THE DRESSING, MANUFACTURE, OR PREPARATION OF TEA BY MECHANICAL MEANS.—ARTIFICIAL WITHERING OF THE LEAF.—MACHINES FOR ROLLING OR CURLING THE LEAF.—FERMENTING PROCESS.—MACHINES FOR THE AUTOMATIC DRYING OR FIRING OF THE LEAF.—MACHINES FOR NON-AUTOMATIC DRYING OR FIRING OF THE LEAF.—DRYING OR FIRING MACHINES.—BREAKING OR CUTTING, AND SORTING MACHINES.—PACKING THE TEA.—MEANS OF TRANSPORT ON TEA PLANTATIONS.—MISCELLANEOUS MACHINERY AND APPARATUS.—FINAL TREATMENT OF THE TEA.—TABLES AND MEMORANDA.

"The subject of tea machinery is now one of the first interest to a large class of people, to whom we strongly commend the volume."—*Chamber of Commerce Journal*.

"When tea planting was first introduced into the British possessions little, if any, machinery was employed, but now its use is almost universal. This volume contains a very full account of the machinery necessary for the proper outfit of a factory, and also a description of the processes best carried out by this machinery."—*Journal Society of Arts*.

FLOUR MANUFACTURE.

A Treatise on Milling Science and Practice. By FRIEDRICH KICK, Imperial Regierungsrath, Professor of Mechanical Technology in the Imperial German Polytechnic Institute, Prague. Translated from the Second Enlarged and Revised Edition, with Supplement. By H. H. P. POWLES, Assoc. Memb. Institution of Civil Engineers. Nearly 400 pp. Illustrated with 28 Folding Plates, and 167 8vo, cloth 25/-

"This invaluable work is, and will remain, the standard authority on the science of milling. The miller who has read and digested this work will have added greatly to his knowledge and experience; he will have acquired a number of generally useful as well as specific knowledge. In this handsome volume we at last have the accepted textbook of modern milling in good, sound English, which has until now scarce had a German translation."—*The Miller*.

"The appearance of this celebrated work in English is very opportune, and British millers will, we are sure, not be slow in availing themselves of its pages."—*Millers' Gazette*.

COTTON MANUFACTURE.

A Manual of Practical Instruction of the Processes of Opening, Carding, Combing, Drawing, Doubling and Spinning of Cotton, the Methods of Dyeing, &c. For the Use of Operatives, Overlookers, and Manufacturers. By JOHN LISTER, Technical Instructor, Pendleton. 8vo, cloth 7/6

"This invaluable volume is a distinct advance in the literature of cotton manufacture."—*Machinery*. "It is thoroughly reliable, fulfilling nearly all the requirements desired."—*Glasgow Herald*.

MODERN CYCLES.

A Practical Handbook on their Construction and Repair. By A. J. WALLIS-TAYLER, A.M.Inst.C.E., Author of "Refrigerating Machinery," &c. With upwards of 300 Illustrations. Crown 8vo, cloth [Just Published. 10/6]

"The large trade that is done in the component parts of bicycles has placed in the way of men mechanically inclined extraordinary facilities for building bicycles for their own use. . . . The book will prove a valuable guide for all those who aspire to the manufacture or repair of their own machines."—*The Field*.

"A most comprehensive and up-to-date treatise."—*The Cycle*.

"A very useful book, which is quite entitled to rank as a standard work for students of cycle construction."—*Wheeling*.

MOTOR CARS OR POWER CARRIAGES FOR COMMON ROADS.

By A. J. WALLIS-TAYLER, Assoc. Memb. Inst. C.E., Author of "Modern Cycles," &c. 212 pp., with 76 Illustrations. Crown 8vo, cloth 4/6

"The book is clearly expressed throughout, and is just the sort of work that an engineer, thinking of turning his attention to motor-carriage work, would do well to read as a preliminary to starting operations."—*Engineering*.

FRENCH POLISHING AND ENAMELLING.

A Practical Work of Instruction. Including Numerous Recipes for making Polishes, Varnishes, Glaze-Lacquers, Revivers, &c. By RICHARD BITMEAD, Author of "The Cabinet-Maker's Guide." Small crown 8vo, cloth.

[Just Published. 1/6]

THE CABINET-MAKER'S GUIDE**TO THE ENTIRE CONSTRUCTION OF CABINET WORK.**

Including Veneering, Marquetry, Buhl-work, Mosaic, Inlaying, &c. By RICHARD BITMEAD. Illustrated with Plans, Sections, and Working Drawings. Small Crown 8vo, cloth.

[Just Published. 2/6]

CEMENTS, PASTES, GLUES AND GUMS.

A Practical Guide to the Manufacture and Application of the various Agglutinants required in the Building, Metal-Working, Wood-Working, and Leather Working Trades, and for Workshop and Office Use. With upwards of 900 Recipes. By H. C. STANDAGE. Third Edition. Crown 8vo, cloth 2/-

"We have pleasure in speaking favourably of this volume. So far as we have had experience, which is not inconsiderable, this manual is trustworthy."—*Athenaeum*.

THE ART OF SOAP-MAKING.

A Practical Handbook of the Manufacture of Hard and Soft Soaps, Toilet Soaps, &c. Including many New Processes, and a Chapter on the Recovery of Glycerine from Waste Leys. By ALEXANDER WATT. Sixth Edition, including an Appendix on Modern Candlemaking. Crown 8vo, cloth 7/6

"The work will prove very useful, not merely to the technological student, but to the practical soap-boiler who wishes to understand the theory of his art."—*Chemical News*.

"A thoroughly practical treatise. We congratulate the author on the success of his endeavour to fill a void in English technical literature."—*Nature*.

PRACTICAL PAPER-MAKING.

A Manual for Paper-Makers and Owners and Managers of Paper-Mills. With Tables, Calculations, &c. By G. CLAPPERTON, Paper-Maker. With Illustrations of Fibres from Micro-Photographs. Crown 8vo, cloth 5/-

"The author writes for the requirements of responsible mill hands, apprentices, &c., whilst his manual will be found of great service to students of technology, as well as to veteran paper-makers and mill-owners. The illustrations form an excellent feature."—*The World's Paper Trade Review*.

THE ART OF PAPER-MAKING.

A Practical Handbook of the Manufacture of Paper from Rags, Esparto, Straw, and other Fibrous Materials. Including the Manufacture of Pulp from Wood Fibre, with a Description of the Machinery and Appliances used. To which are added Details of Processes for Recovering Soda from Waste Liquors. By ALEXANDER WATT. With Illustrations. Crown 8vo, cloth 7/6

"It may be regarded as the standard work on the subject. The book is full of valuable information. It will be of great service to students of technology, as well as to veteran paper-makers and mill-owners. The illustrations form an excellent feature."—*Engineering Papers for the Printing Trade*.

A TREATISE ON PAPER

For Printers and Stationers. With an Outline of Paper Manufacture; Complete Tables of Sizes, and Specimens of Different Kinds of Paper. By RICHARD PARKINSON, late of the Manchester Technical School. Demy 8vo, cloth 3/6

THE ART OF LEATHER MANUFACTURE.

Being a Practical Handbook, in which the Operations of Tanning, Currying, and Leather Dressing are fully Described, and the Principles of Tanning Explained, and many Recent Processes Introduced; as also Methods for the Estimation of Tannin, and a Description of the Arts of Glue Boiling, Gut Dressing, &c. By ALEXANDER WATT. Fourth Edition. Crown 8vo, cloth 9/-

"A sound, comprehensive treatise on tanning and its accessories. The book is an eminently valuable production, which redounds to the credit of both author and publishers."—*Chemical Review*.

THE ART OF BOOT AND SHOE-MAKING.

A Practical Handbook, including Measurement, Last-Fitting, Cutting-Out, Closing and Making, with a Description of the most approved Machinery Employed. By JOHN B. LENO. 12mo, cloth 2/-

WOOD ENGRAVING.

A Practical and Easy Introduction to the Study of the Art. By W. N. BROWN. 12mo, cloth 1/6

"The book is clear and complete, and will be useful to any one wanting to understand the first elements of the beautiful art of wood engraving."—*Graphic*.

MODERN HOROLOGY IN THEORY AND PRACTICE.

Translated from the French of CLAUDIOUS SAUNIER, ex-Director of the School of Horology at Macon, by JULIEN TRIPPLIN, F.R.A.S., Besançon Watch Manufacturer, and EDWARD RIGG, M.A., Assayer in the Royal Mint. With Seventy-eight Woodcuts and Twenty-two Coloured Copper Plates. Second Edition. Super-royal 8vo, £2 2s., cloth; half-calf £2 10s.

"There is no horological work in the English language at M. Saunier's for clearness and completeness. It is alike go reference for the experienced horologist and skilled workman."

"The latest, the most complete, and the most reliable of those literary productions to which continental watchmakers are indebted for the mechanical superiority over their English brethren—in fact, the Book of Books, is M. Saunier's 'Treatise'."—*Watchmaker, Jeweller, and Silversmith*.

THE WATCH ADJUSTER'S MANUAL.

A Practical Guide for the Watch and Chronometer Adjuster in Making, Springing, Timing and Adjusting for Isochronism, Positions and Temperatures. By C. E. FRITTS. 370 pages, with Illustrations, 8vo, cloth 16/-

THE WATCHMAKER'S HANDBOOK.

Intended as a Workshop Companion for those engaged in Watchmaking and the Allied Mechanical Arts. Translated from the French of CLAUDIOUS SAUNIER, and enlarged by JULIEN TRIPPLIN, F.R.A.S., and EDWARD RIGG, M.A., Assayer in the Royal Mint. Third Edition. Crown 8vo, cloth 9/-

"Each part is truly a treatise in itself and the language is clear and concise. It is an admirable guide for the workman."

"It is impossible to speak too highly of this book intended for the use of a workman. Shot

HISTORY OF WATCHES & OTHER TIMEKEEPERS.

By JAMES F. KENDAL, M.B.H.Inst. 1/6 boards; or cloth, gilt 2/6

"The best which has yet appeared on this subject in the English language."—*Industries*,

"Open the book where you may, there is instruction contained in it concerning the ingenious devices of the ancient or modern horologer."—*Saturday Review*.

ELECTRO-DEPOSITION.

A Practical Treatise on the Electrolysis of Gold, Silver, Copper, Nickel, and other Metals and Alloys. With descriptions of Voltaic Batteries, Magneto and Dynamo-Electric Machines, Thermopiles, and of the Materials and Processes used in every Department of the Art, and Several Chapters on ELECTRO-METALLURGY. By ALEXANDER WATT, Author of "Electro-Metallurgy," &c. Third Edition, Revised. Crown 8vo, cloth 9/-

"Eminently a book for the practical worker in electro-deposition. It contains practical descriptions methods, processes and materials, as actually pursued and used in the workshop."—*Engineer*.

ELECTRO-METALLURGY.

Practically Treated. By ALEXANDER WATT. Tenth Edition, including the most recent Processes. 12mo, cloth 3/6

"From this book both amateur and artisan may learn everything necessary for the successful prosecution of electroplating."—*Iron*.

JEWELLER'S ASSISTANT IN WORKING IN GOLD.

A Practical Treatise for Masters and Workmen, Compiled from the Experience of Thirty Years' Workshop Practice. By GEORGE E. GEE, Author of the "Goldsmith's Handbook," &c. Crown 8vo, cloth 7/6

"This manual of technical education is apparently destined to be a valuable auxiliary to a handi-craft which is certainly capable of great improvement."—*The Times*.

ELECTROPLATING.

A Practical Handbook on the Deposition of Copper, Silver, Nickel, Gold, Aluminium, Brass, Platinum, &c., &c. By J. W. URQUHART, C.E. Fourth Edition, Revised. Crown 8vo, cloth. [Just Published. 5/-]
 "An excellent practical manual."—*Engineering*.
 "An excellent work, giving the newest information."—*Horological Journal*.

ELECTROTYPING.

The Reproduction and Multiplication of Printing Surfaces and Works of Art by the Electro-deposition of Metals. By J. W. URQUHART, C.E. Crown 8vo, cloth. 5/-
 "The book is thoroughly practical; the reader is, therefore, conducted through the various processes of electricity, then through the metals used by electrotypers, the apparatus, &c., &c., the different processes, up to the final preparation of the work."—*Art Journal*.

GOLDSMITH'S HANDBOOK.

By GEORGE E. GEE, Jeweller, &c. Fifth Edition. 12mo, cloth. 3/-
 "A good, sound educator, and will be generally accepted as an authority."—*Horological Journal*.

SILVERSMITH'S HANDBOOK.

By GEORGE E. GEE, Jeweller, &c. Third Edition, with numerous Illustrations. 12mo, cloth. 3/-
 "The chief merit of the work is its practical character. . . . The workers in the trade will speedily discover its merits when they sit down to study it."—*English Mechanic*.

* * The above two works together, strongly half-bound, price 7s.

SHEET METAL WORKER'S INSTRUCTOR.

Comprising a Selection of Geometrical Problems and Practical Rules for Describing the Various Patterns Required by Zinc, Sheet-Iron, Copper and Tin-Plate Workers. By REUBEN HENRY WARM, Practical Tin-Plate Worker. New Edition, Revised and greatly Enlarged by JOSEPH G. HORNER, A.M.I.M.E. Crown 8vo, 254 pages, with 430 Illustrations, cloth. [Just Published. 7/6]

BREAD & BISCUIT BAKER'S & SUGAR-BOILER'S ASSISTANT.

Including a large variety of Modern Recipes. With Remarks on the Art of Bread-making. By ROBERT WELLS. Third Edition. Cr. 8vo, cloth. 2/-
 "A large number of wrinkles for the ordinary cook, as well as the baker."—*Saturday Review*.

PASTRYCOOK & CONFECTIONER'S GUIDE.

For Hotels, Restaurants, and the Trade in general, adapted also for Family Use. By R. WELLS, Author of "The Bread and Biscuit Baker." Crown 8vo, cloth. 2/-
 "We cannot speak too highly of this really excellent work. In these days of keen competition our readers cannot do better than purchase this book."—*Baker's Times*.

ORNAMENTAL CONFECTIONERY.

A Guide for Bakers, Confectioners and Pastrycooks; including a variety of Modern Recipes, and Remarks on Decorative and Coloured Work. With 129 Original Designs. By ROBERT WELLS. Second Edition. Crown 8vo, cloth. 5/-
 "A valuable work, practical, and should be in the hands of every baker and confectioner. The illustrative designs are alone worth twice the amount charged for the whole work."—*Baker's Times*.

MODERN FLOUR CONFECTIONER.

Containing a large Collection of Recipes for Cheap Cakes, Biscuits, &c. With Remarks on the Ingredients Used in their Manufacture. By ROBERT WELLS, Author of "The Bread and Biscuit Baker," &c. Crown 8vo, cloth. 2/-
 "The work is of a decidedly practical character, and in every recipe regard is had to economical working."—*North British Daily Mail*.

RUBBER HAND STAMPS

And the Manipulation of Rubber. A Practical Treatise on the Manufacture of Indian-rubber Hand Stamps, Small Articles of Indian-rubber, The Hektograph, Special Inks, Cements and Allied Subjects. By T. O'CONOR SLOANE, A.M., Ph.D. With numerous Illustrations. Square 8vo, cloth. 5/-

HANDYBOOKS FOR HANDICRAFTS.

BY PAUL N. HASLUCK,

Editor of "Work" (New Series), Author of "Lathe Work," "Milling Machines," &c.

Crown 8vo, 144 pages, price 1/- each.

These Handybooks have been written to supply information for WORKMEN, STUDENTS, and AMATEURS in the several Handicrafts, on the actual PRACTICE of the WORKSHOP, and are intended to convey in plain language TECHNICAL KNOWLEDGE of the several CRAFTS. In describing the processes employed, and the manipulation of material, workshop terms are used; workshop practice is fully explained; and the text is freely illustrated with drawings of modern tools, appliances, and processes.

METAL TURNER'S HANDYBOOK.

A Practical Manual for Workers at the Foot-Lathe. With 100 Illustrations 1/-

"The book will be of service alike to the amateur and the artisan turner. It displays thorough knowledge of the subject."—*Soleman*.

WOOD TURNER'S HANDYBOOK.

A Practical Manual for Workers at the Lathe. With over 100 Illustrations 1/-

"We recommend the book to young turners and amateurs. A multitude of workmen have hitherto sought in vain for a manual of this special industry."—*Mechanical World*.

WATCH JOBBER'S HANDYBOOK.

A Practical Manual on Cleaning, Repairing, and Adjusting. With upwards of 100 Illustrations 1/-

"We strongly advise all young persons connected with the watch trade to acquire and study this inexpensive work."—*Clerkenwell Chronicle*.

PATTERN MAKERS' HANDYBOOK.

A Practical Manual on the Construction of Patterns for Founders. With upwards of 100 Illustrations 1/-

"A most valuable, if not indispensable, manual for the pattern maker."—*Knowledge*.

MECHANIC'S WORKSHOP HANDYBOOK.

A Practical Manual on Mechanical Manipulation, embracing Information on various Handicraft Processes. With Useful Notes and Miscellaneous Memoranda. Comprising about 200 Subjects 1/-

"A very clever and useful book, which should be found in every workshop; and it should certainly find a place in all technical schools."—*Saturday Review*.

MODEL ENGINEER'S HANDYBOOK.

A Practical Manual on the Construction of Model Steam Engines. With upwards of 100 Illustrations 1/-

"Mr. Hasluck has produced a very good little book."—*Builder*.

CLOCK JOBBER'S HANDYBOOK.

A Practical Manual on Cleaning, Repairing, and Adjusting. With upwards of 100 Illustrations 1/-

"It is of inestimable service to those commencing the trade."—*Coventry Standard*.

CABINET WORKER'S HANDYBOOK.

A Practical Manual on the Tools, Materials, Appliances, and Processes employed in Cabinet Work. With upwards of 100 Illustrations 1/-

"Mr. Hasluck's thoroughgoing little Handbook is amongst the most practical guides we have seen for beginners in cabinet-work."—*Saturday Review*.

WOODWORKER'S HANDYBOOK.

Embracing Information on the Tools, Materials, Appliances, and Processes Employed in Woodworking. With 104 Illustrations 1/-

"Written by a man who knows not only how work ought to be done, but how to do it, and how to convey his knowledge to others."—*Engineering*.

"Mr. Hasluck writes admirably, and gives complete instructions."—*Engineer*.

"Mr. Hasluck combines the experience of a practical teacher with the manipulative skill and scientific knowledge of processes of the trained mechanician, and the manuals are marvels of what can be produced at a popular price."—*Schoolmaster*.

"Helpful to workmen of all ages and degrees of experience."—*Daily Chronicle*.

"Concise, clear, and practical."—*Saturday Review*.

COMMERCE, COUNTING-HOUSE WORK, TABLES, ETC.

LESSONS IN COMMERCE.

By Professor R. GAMBARO, of the Royal High Commercial School at Genoa. Edited and Revised by JAMES GAULT, Professor of Commerce and Commercial Law in King's College, London. Second Edition, Revised. Crown 8vo, cloth.

3/6

"The publishers of this work have rendered considerable service to the cause of commercial education by the opportune production of this volume. . . . The work is particularly accessible to English readers and an admirable addition to existing class books. In a phrase, we think the work attains its object in furnishing a brief account of those laws and customs of British trade with which the commercial man interested therein should be familiar."—*Chamber of Commerce Journal*.

"An invaluable guide in the hands of those who are preparing for a commercial career, and, in fact, the information it contains on matters of business should be impressed on every mind."—*Counting House*.

THE FOREIGN COMMERCIAL CORRESPONDENT.

Being Aids to Commercial Correspondence in Five Languages—English, French, German, Italian, and Spanish. By CONRAD E. BAKER. Third Edition. Carefully revised throughout. Crown 8vo, cloth.

[Just Published.] 4/6

"Whoever wishes to correspond in all the languages mentioned by Mr. Baker cannot do better than study this work, the materials of which are excellent and conveniently arranged. They consist not of what are for more useful—short passages, sentences, or phrases expressing various forms"—*Athenaeum*. has convinced us that it is unusually complete, well arranged and reliable.

The book is a thoroughly good one."—*Schoolmaster*.

FACTORY ACCOUNTS: THEIR PRINCIPLES AND PRACTICE.

A Handbook for Accountants and Manufacturers, with Appendices on the Nomenclature of Machine Details; the Income Tax Acts; the Rating of Factories; Fire and Boiler Insurance; the Factory and Workshop Acts, &c., including also a Glossary of Terms and a large number of Specimen Rulings. By EMILE GARCKE and J. M. FELLS. Fourth Edition, Revised and Enlarged. Demy 8vo, 250 pages, cloth.

6/-

"A very interesting description of the requirements of Factory Accounts. . . . The principle of assimilating the Factory Accounts to the general commercial books is one which we thoroughly agree with."—*Accountants' Journal*.

"Characterised by extreme thoroughness. There are few owners of factories who would not derive great benefit from the perusal of this most admirable work."—*Local Government Chronicle*.

MODERN METROLOGY.

A Manual of the Metrical Units and Systems of the Present Century. With an Appendix containing a proposed English System. By LOUIS D'A. JACKSON, A.M.Inst.C.E., Author of "Aid to Survey Practice," &c. Large crown 8vo, cloth.

12/6

"We recommend the work to all interested in the practical reform of our weights and measures."—*Nature*.

A SERIES OF METRIC TABLES.

In which the British Standard Measures and Weights are compared with those of the Metric System at present in Use on the Continent. By C. H. DOWLING, C.E. 8vo, cloth.

10/6

"Mr. Dowling's Tables are well put together as a ready reckoner for the conversion of one system into the other."—*Athenaeum*.

IRON AND METAL TRADES' COMPANION.

For expeditiously ascertaining the Value of any Goods bought or sold by Weight, from 1s. per cwt. to 112s. per cwt., and from one farthing per pound to one shilling per pound. By THOMAS DOWIE. Strongly bound in leather, 396 pp.

9/-

"A most useful set of tables, nothing like them before existed."—*Building News*.

"Although specially adapted to the iron and metal trades, the tables will be found useful in every other business in which merchandise is bought and sold by weight."—*Railway News*.

NUMBER, WEIGHT, & FRACTIONAL CALCULATOR.

Containing upwards of 250,000 Separate Calculations, showing at a glance the value at 422 different rates, ranging from $\frac{1}{100}$ th of a Penny to 20s. each, or per cwt., and £20 per ton, of any number of articles consecutively, from 1 to 470.—Any number of cwts., qrs., and lbs., from 1 cwt to 470 cwts.—Any number of tons, cwts., qrs., and lbs., from 1 to 1,000 tons. By WILLIAM CHADWICK, Public Accountant. Third Edition, Revised and Improved. 8vo, strongly bound **18/-**

"It is as easy of reference for any answer or any number of answers as a dictionary. For making invaluable to all who have any considerable quantity of combination to do."—*Engineer.*
"Glasgow Herald.

THE WEIGHT CALCULATOR.

Being a Series of Tables upon a New and Comprehensive Plan, exhibiting at one Reference the exact Value of any Weight from 1 lb. to 15 tons, at 300 Progressive Rates, from 1d. to 168s. per cwt., and containing 186,000 Direct Answers, which, with their Combinations, consisting of a single addition (mostly to be performed at sight), will afford an aggregate of 10,266,000 Answers; the whole being calculated and designed to ensure correctness and promote despatch. By HENRY HARBEN, Accountant. Fifth Edition, carefully corrected. Royal 8vo, strongly half-bound **£1 5s.**

"A practical and useful work of reference for men of business generally."—*Ironmonger.*
"Of priceless value to business men. It is a necessary book in all mercantile offices."—*Sheffield Independent.*

THE DISCOUNT GUIDE.

Comprising several Series of Tables for the Use of Merchants, Manufacturers, Ironmongers, and others, by which may be ascertained the exact Profit arising from any mode of using Discounts, either in the Purchase or Sale of Goods, and the method of either Altering a Rate of Discount, or Advancing a Price, so as to produce, by one operation, a sum that will realise any required profit after allowing one or more Discounts; to which are added Tables of Profit or Advance from 1 $\frac{1}{2}$ to 90 per cent., Tables of Discount from $\frac{1}{2}$ to 98 $\frac{1}{2}$ per cent., and Tables of Commission, &c., from $\frac{1}{2}$ to 10 per cent. By HENRY HARBEN, Accountant. New Edition, Corrected. Demy 8vo, half-bound **£1 5s.**

"A book such as this can only be appreciated by business men, to whom the saving of time means saving of money. The work must prove of great value to merchants, manufacturers, and general traders."—*British Trade Journal.*

TABLES OF WAGES.

At 54, 52, 50, and 48 Hours per Week. Showing the Amounts of Wages from One-quarter-of-an-hour to Sixty-four hours in each case at Rates of Wages advancing by One Shilling from 4s. to 55s. per week. By THOS. GARBUZZ, Accountant. Square crown 8vo, half-bound **6/-**

IRON-PLATE WEIGHT TABLES.

For Iron Shipbuilders, Engineers and Iron Merchants. Containing the Calculated Weights of Upwards of 1500 different sizes of Iron Plates from 1 foot by 6 in. by $\frac{1}{2}$ in. to 10 feet by 5 feet by 1 in. Worked out on the basis of 40 lbs. to the square foot of Iron of 1 inch in thickness. By H. BURLINSON and W. H. SIMPSON. 4to, half-bound **25/-**

MATHEMATICAL TABLES (ACTUARIAL).

Comprising Commutation and Conversion Tables, Logarithms, Cologarithms, Antilogarithms and Reciprocals. By J. W. GORDON. Royal 8vo, mounted on canvas, in cloth case. [Just Published. **5/-**]

AGRICULTURE, FARMING, GARDENING, ETC.

THE COMPLETE GRAZIER AND FARMER'S AND CATTLE BREEDER'S ASSISTANT.

A Compendium of Husbandry. Originally Written by WILLIAM YOUNATT. Fourteenth Edition, entirely Re-written, considerably Enlarged, and brought up to Present Requirements, by WILLIAM FREEMAN, LL.D., Assistant Commissioner Royal Commission on Agriculture, Author of "The Elements of Agriculture," &c. Royal 8vo, 1,100 pp., with over 450 Illustrations. Handsomely bound.

[Just Published. £1 11s. 6d.]

SUMMARY OF CONTENTS.

- BOOK I. ON THE VARIETIES, BREEDING, REARING, FATTENING AND MANAGEMENT OF CATTLE.
- BOOK II. ON THE ECONOMY AND MANAGEMENT OF THE DAIRY.
- BOOK III. ON THE BREEDING, REARING, AND MANAGEMENT OF HORSES.
- BOOK IV. ON THE BREEDING, REARING, AND FATTENING OF SHEEP.
- BOOK V. ON THE BREEDING, REARING, AND FATTENING OF SWINE.
- BOOK VI. ON THE DISEASES OF LIVE STOCK.
- BOOK VII. ON THE BREEDING, REARING, AND MANAGEMENT OF POULTRY.
- BOOK VIII. ON FARM OFFICES AND IMPLEMENTS OF HUSBANDRY.
- BOOK IX. ON THE CULTURE AND MANAGEMENT OF GRASS LANDS.
- BOOK X. ON THE CULTIVATION AND APPLICATION OF GRASSES, PULSE AND ROOTS.
- BOOK XI. ON MANURES AND THEIR APPLICATION TO GRASS LAND AND CROPS.
- BOOK XII. MONTHLY CALENDARS OF FARMWORK.

* * OPINIONS OF THE PRESS.

"Dr. Freeman is to be congratulated on the successful attempt he has made to give us a work which will at once become the standard classic of the farm practice of the country. We believe that it will be found 'far and away the best work upon the many works at present in existence.' . . . The illustrations are admirable, and the frontispiece, which represents the well-known bull, New Year's Gift, bred by the Queen, is a work of art."—*The Times*.

"The book must be recognised as occupying the proud position of the most exhaustive work of reference in the English language on the subject with which it deals."—*Athenaeum*.

"The most comprehensive guide to modern farm practice that exists in the English language to-day. . . . The book is one that ought to be on every farm and in the library of every land owner."—*Mark Lane Express*.

"In point of exhaustiveness and accuracy the work will certainly hold a pre-eminent and unique position among books dealing with scientific agricultural practice. It is, in fact, an agricultural library of itself."

"A really complete work on the history, breeds, and management of the farm stock of Great Britain, and one which is likely to find its way to the shelves of every country gentleman's library."—*The Times*.

"The latest edition of 'Farm Live Stock of Great Britain' is a production to be proud of, and its issue not the least of the services which its author has rendered to agricultural science."—*Scottish Farmer*.

"The book is very attractive, . . . and we can scarcely imagine the existence of a farmer who would not like to have a copy of this beautiful and useful work."—*Mark Lane Express*.

FARM LIVE STOCK OF GREAT BRITAIN.

By ROBERT WALLACE, F.L.S., F.R.S.E., &c., Professor of Agricultural and Rural Economy in the University of Edinburgh. Third Edition, thoroughly Revised and considerably Enlarged. With over 120 Phototypes of Prize Stock. Demy 8vo, 384 pp., with 79 Plates and Maps. Cloth **12/6**

"A really complete work on the history, breeds, and management of the farm stock of Great Britain, and one which is likely to find its way to the shelves of every country gentleman's library."—*The Times*.

"The latest edition of 'Farm Live Stock of Great Britain' is a production to be proud of, and its issue not the least of the services which its author has rendered to agricultural science."—*Scottish Farmer*.

"The book is very attractive, . . . and we can scarcely imagine the existence of a farmer who would not like to have a copy of this beautiful and useful work."—*Mark Lane Express*.

NOTE-BOOK OF AGRICULTURAL FACTS AND FIGURES FOR FARMERS AND FARM STUDENTS.

By PRIMROSE McCONNELL, B.Sc., Fellow of the Highland and Agricultural Society, Author of "Elements of Farming." Sixth Edition, Rewritten, Revised, and greatly Enlarged. F'cap. 8vo, 480 pages, leather, gilt edges.

[Just Published. 6/-]

SUMMARY OF CONTENTS.

SURVEYING AND LEVELLING.—WEIGHTS AND MEASURES.—MACHINERY AND BUILDINGS.—LABOUR.—OPERATIONS.—DRAINING.—EMBANKING.—GEOLOGICAL MEMORANDA.—SOILS.—MANURES.—CROPPING.—CROPS.—ROTATIONS.—WEEDS.—FEEDING.—DAIRYING.—LIVE STOCK.—HORSES.—CATTLE.—SHEEP.—PIGS.—POULTRY.—FORESTRY.—HORTICULTURE.—MISCELLANEOUS.

"No farmer, and certainly no agricultural student, ought to be without this *missum in parvo* manual of all subjects connected with the farm."—*North British Agriculturist*.

"This little pocket-book contains a large amount of useful information upon all kinds of agricultural subjects. Something of the kind has long been wanted."—*Mark Lane Express*.

"The amount of information it contains is most surprising: the arrangement of the matter is so methodical—although so compressed—as to be intelligible to every one who takes a glance through its pages. They teem with information."—*Farm and Home*.

BRITISH DAIRYING.

A Handy Volume on the Work of the Dairy-Farm. For the Use of Technical Instruction Classes, Students in Agricultural Colleges and the Working Dairy-Farmer. By Prof. J. P. SHELDON. With Illusts. Second Edition, Revised. Crown 8vo, cloth. [Just Published. 2/6]

"Confidently recommended as a useful text-book on dairy farming."—*Agricultural Gazette*.
"Probably the best half-crown manual on dairy work that has yet been produced."—*North British Agriculturist*.

"It is the soundest little work we have yet seen on the subject."—*The Times*.

MILK, CHEESE, AND BUTTER.

A Practical Handbook on their Properties and the Processes of their Production. Including a Chapter on Cream and the Methods of its Separation from Milk. By JOHN OLIVER, late Principal of the Western Dairy Institute, Berkeley. With Coloured Plates and 200 Illustrations. Crown 8vo, cloth. 7/6

"An exhaustive and masterly production. It may be cordially recommended to all students and practitioners of dairy science."—*N.B. Agriculturist*.
"We recommend it to all who are interested in the subject."—*Farmer and Stockbreeder*.
"We recommend it to all who are interested in the subject."—*Agricultural Gazette*.

SYSTEMATIC SMALL FARMING.

Or, The Lessons of my Farm. Being an introduction to Modern Farm Practice for Small Farmers. By R. SCOTT BURN, Author of "Outlines of Modern Farming," &c. Crown 8vo, cloth. 6/-
"This is the completest book of its class we have seen, and one which every amateur farmer will read with pleasure, and accept as a guide."—*Field*.

OUTLINES OF MODERN FARMING.

By R. SCOTT BURN. Soils, Manures, and Crops—Farming and Farming Economy—Cattle, Sheep, and Horses—Management of Dairy, Pigs, and Poultry—Utilization of Farm Produce, &c. Sixth Edition. In one vol., 1,250 pp., half-bound, 12/-

FARM ENGINEERING, THE COMPLETE TEXT-BOOK OF
Comprising Draining and Embarking; Irrigation and Water Supply; Farm Roads, Fences, and Gates; Farm Buildings; Barn Implements and Machines; Field Implements and Machines; Agricultural Surveying, &c. By Professor JOHN SCOTT. In one vol., 1,150 pp., half-bound, with over 600 Illustrations, 12/-
"Written with great care, as well as with knowledge and ability. The author has done his work well; we have found him a very trustworthy guide wherever we have tested his statements. The volume will be of great value to agricultural students."—*Mark Lane Express*.

THE FIELDS OF GREAT BRITAIN.

A Text-Book of Agriculture. Adapted to the Syllabus of the Science and Art Department. For Elementary and Advanced Students. By HUGH CLEMENTS (Board of Trade). Second Edition, Revised, with Additions. 18mo, cloth. 2/6
"It is a long time since we have seen a book which has pleased us more, or which contains such a vast and useful fund of knowledge."—*Educational Times*.

TABLES AND MEMORANDA FOR FARMERS, GRAZIERS, AGRICULTURAL STUDENTS, SURVEYORS, LAND AGENTS, AUCTIONEERS, &c.

With a New System of Farm Book-keeping. By SIDNEY FRANCIS. Fifth Edition. 272 pp., waistcoat-pocket size, limp leather. [Just Published. 1/6]
"Weighing less than 1 oz., and occupying no more space than a match box, it contains a mass of facts and calculations which has never before, in such handy form, been obtainable. Every operation on the farm is dealt with. The work may be taken as thoroughly accurate, the whole of the tables having been revised by Dr. Fream. We cordially recommend it."—*Neil's Weekly Messenger*.

THE Rothamsted Experiments and Their Practical Lessons for Farmers.

Part I. Stock. Part II. Crops. By C. J. R. TIPPER. Crown 8vo, cloth. [Just Published. 3/6]
"We have no doubt that the book will be welcomed by a large class of farmers and others interested in agriculture."—*Standard*.

FERTILISERS AND FEEDING STUFFS.

Their Properties and Uses. A Handbook for the Practical Farmer. By BERNARD DYER, D.Sc. (Lond.). With the Text of the Fertilisers and Feeding Stuffs Act of 1893, &c. Third Edition, Revised. Crown 8vo, cloth.

[Just Published. 1/-]

"This little book is precisely what it professes to be—'A Handbook for the Practical Farmer.' Dr. Dyer has done farmers good service in placing at their disposal so much useful information in so intelligible a form."—*The Times*.

BEES FOR PLEASURE AND PROFIT:

Guide to the Manipulation of Bees, the Production of Honey, and the General Management of the Apiary. By G. GORDON SAMSON. With numerous Illustrations. Crown 8vo, cloth.

1/-

BOOK-KEEPING FOR FARMERS AND ESTATE OWNERS.

A Practical Treatise, presenting, in Three Plans, a System adapted for all Classes of Farms. By JOHNSON M. WOODMAN, Chartered Accountant. Second Edition, Revised. Crown 8vo, cloth.

2/6

"The volume is a capital study of a most important subject."—*Agricultural Gazette*.

WOODMAN'S YEARLY FARM ACCOUNT BOOK.

Giving Weekly Labour Account and Diary, and showing the Income and Expenditure under each Department of Crops, Live Stock, Dairy, &c., &c. With Valuation, Profit and Loss Account, and Balance Sheet at the end of the Year. By JOHNSON M. WOODMAN, Chartered Accountant. Second Edition. Folio, half-bound.

[Net] 7/6

"Contains every requisite for keeping farm accounts readily and accurately."—*Agriculture*.

THE FORCING-GARDEN.

Or, How to Grow Early Fruits, Flowers, and Vegetables. With Plans and Estimates for Building Glasshouses, Pits and Frames. With Illustrations. By SAMUEL WOOD. Crown 8vo, cloth.

3/6

"A good book, containing a great deal of valuable teaching."—*Gardener's Magazine*.

A PLAIN GUIDE TO GOOD GARDENING.

Or, How to Grow Vegetables, Fruits, and Flowers. By S. WOOD. Fourth Edition, with considerable Additions, &c., and numerous Illustrations. Crown 8vo, cloth.

3/6

"A very good book, and one to be highly recommended as a practical guide. The practical directions are excellent."—*Athenaeum*.

MULTUM-IN-PARVO GARDENING.

Or, How to make One Acre of Land produce £620 a year, by the Cultivation of Fruits and Vegetables; also, How to Grow Flowers in Three Glass Houses, so as to realise £176 per annum clear Profit. By SAMUEL WOOD, Author of "Good Gardening," &c. Sixth Edition. Crown 8vo, sewed.

1/-

THE LADIES' MULTUM-IN-PARVO FLOWER GARDEN.

And Amateur's Complete Guide. By S. WOOD. Crown 8vo, cloth.

3/6

POTATOES: HOW TO GROW AND SHOW THEM.

A Practical Guide to the Cultivation and General Treatment of the Potato. By J. PINK. Crown 8vo.

2/-

MARKET AND KITCHEN GARDENING.

By C. W. SHAW, late Editor of "Gardening Illustrated." Cloth.

3/-

AUCTIONEERING, VALUING, LAND SURVEYING, ESTATE AGENCY, ETC.

INWOOD'S TABLES FOR PURCHASING ESTATES AND FOR THE VALUATION OF PROPERTIES.

Including Advowsons, Assurance Policies, Copyholds, Deferred Annuities, Freeholds, Ground Rents, Immediate Annuities, Leaseholds, Life Interests Mortgages, Perpetuities, Renewals of Leases, Reversions, Sinking Funds, &c., &c. 26th Edition, Revised and Extended by WILLIAM SCHOOLING, F.R.A.S., with Logarithms of Natural Numbers and THOMAN's Logarithmic Interest and Annuity Tables. 360 pp., demy 8vo, cloth. [Just Published. Net 8/-]

"Those interested in the purchase and sale of estates, and in the adjustment of compensation cases, as well as in transactions in annuities, life insurances, &c., will find the present edition of eminent service."—*Engineering*.

"This valuable book has been considerably enlarged and improved by the labours of Mr. Schooling, and is now very complete in itself."—*Engineering*.

"Will be of great value to many classes of professional men in saving their many time and trouble in calculation."—*Investors' Review*.

THE APPRAISER, AUCTIONEER, BROKER, HOUSE AND ESTATE AGENT AND VALUER'S POCKET ASSISTANT,

For the Valuation for Purchase, Sale, or Renewal of Leases, Annuities and Reversions, and of property generally; with Prices for Inventories, &c. By JOHN WHEELER, Valuer, &c. Sixth Edition, Re-written and greatly Extended by C. NORRIS. Royal 32mo, cloth 5/-

"A neat and concise book of reference, containing an admirable and clearly-arranged list of prices for inventories, and a very practical guide to determine the value of furniture, &c."—*Standard*.

"Contains a large quantity of varied and useful information as to the valuation for purchase, sale, or renewal of leases, annuities and reversions, and of property generally, with prices for inventories, and a guide to determine the value of interior fittings and other effects."—*Builder*.

AUCTIONEERS: THEIR DUTIES AND LIABILITIES.

A Manual of Instruction and Counsel for the Young Auctioneer. By ROBERT SQUIBB, Auctioneer. Second Edition, Revised. Demy 8vo, cloth 12/6

"The work is one of general excellent character, and gives much information in a compendious and satisfactory form."—*Builder*.

"May be recommended as giving a great deal of information on the law relating to auctioneers, in a very readable form."—*Law Journal*.

THE AGRICULTURAL VALUER'S ASSISTANT.

A Practical Handbook on the Valuation of Landed Estates; including Example of a Detailed Report on Management and Realisation; Forms of Valuations of Tenant Right; Lists of Local Agricultural Customs; Scales of Compensation under the Agricultural Holdings Act, and a Brief Treatise on Compensation under the Lands Clauses Acts, &c. By TOM BRIGHT, Agricultural Valuer, Author of "The Agricultural Surveyor and Estate Agent's Handbook." Fourth Edition, Revised, with Appendix containing a Digest of the Agricultural Holdings Acts, 1883-1900. Crown 8vo, cloth. [Just Published. Net 6/-]

"Full of tables and examples in connection with the valuation of tenant-right, estates, labour, contents and weights of timber, and farm produce of all kinds."—*Agri. and Past. Gazette*.

"An eminently practical handbook, full of practical hints and data of undoubted interest and value to surveyors and auctioneers in preparing valuations of all kinds."—*Farmer*.

POLE PLANTATIONS AND UNDERWOODS.

A Practical Handbook on Estimating the Cost of Forming, Renovating, Improving, and Grubbing Plantations and Underwoods, their Valuation for Purposes of Transfer, Rental, Sale or Assessment. By TOM BRIGHT. Crown 8vo, cloth 3/6

"To valuers, foresters and agents it will be a welcome aid."—*North British Agriculturist*.

"Well calculated to assist the valuer in the discharge of his duties, and of undoubted interest and use both to surveyors and auctioneers in preparing valuations of all kinds."—*Kew Herald*.

AGRICULTURAL SURVEYOR AND ESTATE AGENT'S HANDBOOK.

Of Practical Rules, Formulae, Tables, and Data. A Comprehensive Manual for the Use of Surveyors, Agents, Landowners, and others interested in the Equipment, the Management, or the Valuation of Landed Estates. By TOM BRIGHT, Agricultural Surveyor and Valuer, Author of "The Agricultural Valuer's Assistant," &c. With Illustrations. Fcap. 8vo, Leather.

[Just Published. Net 7/6]

"An exceedingly useful book, the contents of which are admirably chosen. The classes for whom the work is intended will find it convenient to have this comprehensive handbook accessible for reference."—*Live Stock Journal*.

"It is a singularly compact and well informed compendium of the facts and figures likely to be required in estate work, and is certain to prove of much service to those to whom it is addressed."—*Scotsman*.

THE LAND VALUER'S BEST ASSISTANT.

Being Tables on a very much improved Plan, for Calculating the Value of Estates, With Tables for reducing Scotch, Irish, and Provincial Customary Acres to Statute Measure, &c. By R. HURSTON, C.E. New Edition. Royal 32mo, leather, elastic band 4/-

"Of incalculable value to the country gentleman and professional man."—*Farmers' Journal*.

THE LAND IMPROVER'S POCKET-BOOK.

Comprising Formulae, Tables, and Memoranda required in any Computation relating to the Permanent Improvement of Landed Property. By JOHN EWART, Surveyor. Second Edition, Revised, Royal 32mo, oblong, leather 4/-

"A compendious and handy little volume."—*Spectator*.

THE LAND VALUER'S COMPLETE POCKET-BOOK.

Being the above Two Works bound together. Leather 7/6

HANDBOOK OF HOUSE PROPERTY.

A Popular and Practical Guide to the Purchase, Tenancy, and Compulsory Sale of Houses and Land, including Dilapidations and Fixtures: with Examples of all kinds of Valuations, Information on Building and on the right use of Decorative Art. By E. L. TARBUCK, Architect and Surveyor. Sixth Edition. 12mo, cloth

[Just Published. 5/-]

"Is an indispensable guide."—*Decoration*.
"by the addition of a division on Fine Art. A
well rd."

LAW AND MISCELLANEOUS.

MODERN JOURNALISM.

A Handbook of Instruction and Counsel for the Young Journalist. By JOHN B. MACKIE, Fellow of the Institute of Journalists. Crown 8vo, cloth 2/-

"This invaluable guide to journalism is a work which all aspirants to a journalistic career will read with advantage."—*Journalist*.

HANDBOOK FOR SOLICITORS AND ENGINEERS

Engaged in Promoting Private Acts of Parliament and Provisional Orders, for the authorization of Railways, Tramways, Gas and Water Works, &c. By L. L. MACASSEY, of the Middle Temple, Barrister-at-Law, N.I.C.E. 8vo, cloth 5/-

PATENTS FOR INVENTIONS, HOW TO PROCURE THEM.

Compiled for the Use of Inventors, Patentees and others. By G. G. M. HARDEINGHAM, Assoc. Mem. Inst. C.E., &c. Demy 8vo, cloth 1/-

CONCILIATION AND ARBITRATION, IN LABOUR DISPUTES.

A Historical Sketch and Brief Statement of the Present Position of the Question at Home and Abroad. By J. S. JEANS. Crown 8vo, 200 pp., cloth 2/-

EVERY MAN'S OWN LAWYER.

A Handy-Book of the Principles of Law and Equity. With a CONCISE DICTIONARY OF LEGAL TERMS. By A BARRISTER. Thirty-Eighth Edition, carefully revised, and including New Acts of Parliament of 1900. Comprising the *Companies Act*, 1900; the *Money-Lenders Act*, 1900; the *Agricultural Holdings Act*, 1900; the *Workmen's Compensation Act*, 1900; the *Wild Animals in Captivity Protection Act*, 1900; the *Finance Act*, 1900, and other enactments of the year. Judicial Decisions during the year have also been duly noted. Crown 8vo, 750 pp., strongly bound in cloth. [Just Published. 6*s*]

* * * This Standard Work of Reference forms a COMPLETE EPITOME OF THE LAWS OF ENGLAND, comprising (amongst other matter) :

THE RIGHTS AND WRONGS OF INDIVIDUALS — LANDLORD AND TENANT — VENDORS AND PURCHASERS — LEASES AND MORTGAGES — PRINCIPAL AND AGENT — PARTNERSHIP AND COMPANIES — MASTERS, SERVANTS AND WORKMEN — CONTRACTS AND AGREEMENTS — BORROWERS, LENDERS AND SURETIES — SALE AND PURCHASE OF GOODS — CHEQUES, BILLS AND NOTES — BILLS OF SALE — BANKRUPTCY — RAILWAY AND SHIPPING LAW — LIFE, FIRE, AND MARINE INSURANCE — ACCIDENT AND FIDELITY INSURANCE — CRIMINAL LAW — PARLIAMENTARY ELECTIONS — COUNTY COUNCILS — DISTRICT COUNCILS — PARISH COUNCILS — MUNICIPAL CORPORATIONS — LIBEL AND SLANDER — PUBLIC HEALTH AND NUISANCES — COPYRIGHT, PATENTS, TRADE MARKS — HUSBAND AND WIFE — DIVORCE — INFANCY — CUSTODY OF CHILDREN — TRUSTEES AND EXECUTORS — CLERGY, CHURCHWARDENS, ETC. — GAME LAWS AND SPORTING — INNKEEPERS — HORSES AND DOGS — TAXES AND DEATH DUTIES — FORMS OF AGREEMENTS, WILLS, CODICILS, NOTICES, ETC.

* * The object of this work is to enable those who consult it to help themselves to the law; and thereby to dispense, as far as possible, with professional assistance and advice. There are many wrongs and grievances which persons submit to from time to time through not knowing how or where to apply for redress; and many persons have as great a dread of a lawyer's office as of a lion's den. With this book at hand it is believed that many a SIX-AND-EIGHTPENCE may be saved; many a wrong redressed; many a right reclaimed; many a law suit avoided; and many an evil abated. The work has established itself as the standard legal adviser of all classes, and has also made a reputation for itself as a useful book of reference for lawyers residing at a distance from law libraries, who are glad to have at hand a work embodying recent decisions and enactments.

* * OPINIONS OF THE PRESS.

"It is a complete code of English Law written in plain language, which all can understand. . . . Should be in the hands of every business man, and all who wish to brush lawyers' bills." — *Weekly Times*.

"A useful and concise epitome of the law, compiled with considerable care." — *Law Magazine*.

"A complete digest of the most useful facts which constitute English law." — *Globe*.

"This excellent handbook. . . . Admirably done, admirably arranged, and admirably cheap." — *Leeds Mercury*.

"A concise, cheap, and complete epitome of the English law. So plainly written that he who runs may read, and he who reads may understand." — *Figaro*.

"A dictionary of legal facts well put together. The book is a very useful one." — *Spectator*.

THE PAWNBROKERS', FACTORS', AND MERCHANTS' GUIDE TO THE LAW OF LOANS AND PLEDGES.

With the Statutes and a Digest of Cases. By H. C. FOLKARD, Barrister-at-Law. Cloth

3*s*

LABOUR CONTRACTS.

A Popular Handbook on the Law of Contracts for Works and Services. By DAVID GIBBONS. Fourth Edition, with Appendix of Statutes by T. F. UTTLEY, Solicitor. Fcap. 8vo, cloth

3*s*

SUMMARY OF THE FACTORY AND WORKSHOP ACTS

(1878-1891). For the Use of Manufacturers and Managers. By EMILE GACKE and J. M. FELLS. (Reprinted from "FACTORY ACCOUNTS.") Crown 8vo, sewed.

6*d*

WEALE'S SERIES
OF
SCIENTIFIC & TECHNICAL
WORKS.

"It is not too much to say that no books have ever proved more popular with or more useful to young engineers and others than the excellent treatises comprised in WEALE'S SERIES."—*Engineer.*

A New Classified List.

PAGE		PAGE	
Civil Engineering and Surveying	50	Industrial and Useful Arts . . .	57
Mining and Metallurgy . . .	51	Agriculture, Gardening, Etc. . .	58
Mechanical Engineering . . .	52	Mathematics, Arithmetic, Etc. . .	60
Navigation, Shipbuilding, Etc. .	53	Books of Reference and Mis-	
Architecture and Building . . .	54	cellaneous Volumes	62



CROSBY LOCKWOOD AND SON,
7, STATIONERS' HALL COURT, LONDON, E.C.
1901.

CIVIL ENGINEERING & SURVEYING.**Civil Engineering.**

By HENRY LAW, M. Inst. C.E. Including a Treatise on HYDRAULIC ENGINEERING by G. R. BURNELL, M.I.C.E. Seventh Edition, revised, with LARGE ADDITIONS ON RECENT PRACTICE by D. KINNEAR CLARK, M. Inst. C.E. 6/6, cloth boards 7/6
"An admirable volume, which we warmly recommend to young engineers."—*Builder*.

Pioneer Engineering.

A Treatise on the Engineering Operations connected with the Settlement of Waste Lands in New Countries. By E. DOBSON, M. Inst. C.E. Second Edition. 4/6
"Mr. Dobson is familiar with the difficulties which have to be overcome in this class of work, and much of his advice will be valuable to young engineers proceeding to our colonies."—*Engineering*.

Iron and Steel Bridges and Viaducts.

A Practical Treatise upon their Construction. For the use of Engineers, Draughtsmen, and Students. By FRANCIS CAMPIN, C.E. 3/6

Iron Bridges of Moderate Span:

Their Construction and Erection. By H. W. PENDRED. With 40 illustrations 2/0
"Students and engineers should obtain this book for constant and practical use."—*Colliery Guardian*.

Constructional Iron and Steel Work,

As applied to Public, Private, and Domestic Buildings. By FRANCIS CAMPIN, C.E. 3/6
"This practical book may be counted a most valuable work."—*British Architect*.

Tubular and other Iron Girder Bridges,

Describing the Britannia and Conway Tubular Bridges. With a Sketch of Iron Bridges, &c. By G. DRYSDALE DEMPSEY, C.E. Fourth Edition 2/0

Materials and Construction.

A Theoretical and Practical Treatise on the Strains, Designing, and Erection of Works of Construction. By FRANCIS CAMPIN, C.E. Second Edition 3/0
"No better exposition of the practical application of the principles of construction has yet been published to our knowledge in such a cheap comprehensive form."—*Building News*.

Sanitary Work in Small Towns and Villages.

By CHARLES SLAGG, Assoc. M. Inst. C.E. Second Edition, Enlarged 3/0
"This is a very useful book. There is a great deal of work required to be done in the smaller towns and villages, and this little volume will help those who are willing to do it."—*Builder*.

Construction of Roads and Streets.

In Two Parts: I. THE ART OF CONSTRUCTING COMMON ROADS, by H. LAW, C.E., Revised by D. KINNEAR CLARK, C.E.; II. RECENT PRACTICE: Including Pavements of Stone, Wood, and Asphalt. By D. K. CLARK, C.E. 4/6
"A book which every borough surveyor and engineer must possess, and which will be of considerable service to architects, builders, and property owners generally."—*Building News*.

Construction of Gas Works,

And the Manufacture and Distribution of Coal Gas. By S. HUGHES, C.E. Re-written by WILLIAM RICHARDS, C.P. Eighth Edition, with important Additions 5/6
"Will be of infinite service alike to manufacturers, distributors, and consumers."—*Ironman Engineer*.

Water Works, for the Supply of Cities and Towns.

With a Description of the Principal Geological Formations of England as influencing Supplies of Water. By SAMUEL HUGHES 4/0
"Everyone who is debating how his village, town, or city shall be plentifully supplied with pure water should read this book."—*Newcastle Courant*.

Power of Water.

As applied to drive Flour Mills, and to give motion to Turbines and other Hydrostatic Engines. By JOSEPH GILLYN, F.R.S., &c. New Edition. Illustrated 2/0

Wells and Well-Sinking.

By J. G. SWINDELL, A.R.I.B.A., and G. R. BURNELL, C.E. Revised Edition 2/0
"Solid practical information, written in a concise and lucid style. The work can be recommended as a text-book for all surveyors, architects, &c."—*Iron and Coal Trades Review*.

Drainage of Lands, Towns, and Buildings.

By G. D. DEMPSEY, C.E. Revised, with large Additions on Recent Practice in Drainage Engineering, by D. KINNEAR CLARK, M.I.C.E. Third Edition 4/6

Blasting and Quarrying of Stone,

For Building and other Purposes. With Remarks on the Blowing up of Bridges.
By Gen. Sir J. BURGOYNE, K.C.B. 1/6

Foundations and Concrete Works.

With Practical Remarks on Footings, Piling, Sand, Concrete, Béton, Pile-driving,
Caissons, and Cofferdams. By E. DODSON, M.I.M.E.A. Seventh Edition 1/6

Pneumatics,

Including Acoustics and the Phenomena of Wind Currents, for the use of Beginners.
By CHARLES TOMLINSON, F.R.S. Fourth Edition, enlarged. Illustrated 1/6

Land and Engineering Surveying.

For Students and Practical Use. By T. BAKER, C.E. Eighteenth Edition, revised
and extended by F. E. DIXON, A.M. Inst. C.E. Illustrated with Plates and Diagrams.
[Just published.] 2/0

Mensuration and Measuring,

With the Mensuration and Levelling of Land for the purposes of Modern Engineering.
By T. BAKER, C.E. New Edition by E. NUGENT, C.E. 1/6

MINING AND METALLURGY.**Mineralogy,**

Rudiments of. By A. RAMSAY, F.G.S. Third Edition. Woodcuts and Plates 3/6
"The author throughout has displayed an intimate knowledge of his subject, and great facility in
imparting that knowledge to others. The book is of great utility."—*Mining Journal*.

Coal and Coal Mining,

By the late Sir WARINGTON W. SMYTH, M.A., F.R.S., Eighth Edition, Revised and
Extended by T. FORSTER BROWN, Chief Inspector of the Mines of the Crown and of
the Duchy of Cornwall. [Just Published.] 3/6

"Every portion of the volume appears to have been prepared with much care, and as an outline is
given of every known coal-field in this and other countries, as well as of the two principal methods of
working, the book will doubtless interest a very large number of readers."—*Mining Journal*.

Metallurgy of Iron.

Containing History of Iron Manufacture, Methods of Assay, and Analyses of Iron Ores,
Processes of Manufacture of Iron and Steel, &c. By H. BAUERMAN, F.G.S., A.R.S.M.
With numerous Illustrations. Sixth Edition, revised and enlarged 5/0

"Carefully written, it has the merit of brevity and conciseness, as to less important points; while all
material matters are very fully and thoroughly entered into."—*Standard*.

Mineral Surveyor & Valuer's Complete Guide.

Comprising a Treatise on Improved Mining Surveying and the Valuation of Mining
Properties, with New Traverse Tables. By W. LINTERN, C.E., Third Edition, with an
Appendix on Magnetic and Angular Surveying, with Records of the Peculiarities of
Needle Disturbances. With Four Plates of Diagrams, Plans, &c. 3/6

"Contains much valuable information, and is thoroughly trustworthy."—*Iron & Coal Trades Review*.

Slate and Slate Quarrying,

Scientific, Practical, and Commercial. By D. C. DAVIES, F.G.S., Mining Engineer, &c.
With numerous Illustrations and Folding Plates. Third Edition 3/0

"One of the best and best-balanced treatises on a special subject that we have met with."—*Engineer*.

A First Book of Mining and Quarrying,

With the Sciences connected therewith, for Primary Schools and Self-instruction. By
J. H. COLLINS, F.G.S. Second Edition, with Additions 1/6

"For those concerned in schools in the mining districts, this work is the very thing that should be in
the hands of their schoolmasters."—*Iron*.

Subterraneous Surveying.

By THOMAS FENWICK. Also the Method of Conducting Subterraneous Surveys
without the use of the Magnetic Needle, &c. By T. BAKER, C.E. 2/6

Mining Tools,

Manual of. By W. MORGANS, Lecturer on Mining at the Bristol School of Mines 2/6

Mining Tools, Atlas

Of Engravings to the above, containing 235 Illustrations drawn to Scale. 4to. 4/6

"Students, Overmen, Captains, Managers, and Viewers may gain practical knowledge and useful
hints by the study of Mr. Morgans' Manual."—*Colliery Guardian*.

Physical Geology,

Partly based on Major-General PORTLOCK's "Rudiments of Geology." By RALPH TATE, A.L.S., &c. Woodcuts 2/0

Historical Geology,

Partly based on Major-General PORTLOCK's "Rudiments." By RALPH TATE 2/6

Geology,

PHYSICAL and HISTORICAL. Consisting of "Physical Geology," which sets forth the Leading Principles of the Science; and "Historical Geology," which treats of the Mineral and Organic Conditions of the Earth at each successive epoch. By RALPH TATE, F.G.S. With 250 Illustrations 4/0

"The fulness of the matter has elevated the book into a manual. Its information is exhaustive and well-arranged, so that any subject may be opened upon at once."—*School Board Chronicle*.

MECHANICAL ENGINEERING.**Workman's Manual of Engineering Drawing.**

By JOHN MAXTON, Instructor in Drawing in the Flying Wing, Royal Naval College, Greenwich. Seventh Edition. 300 Figs. 3/6

"A copy of it should be kept for reference in every drawing office."—*Engineering*.

Fuels : Solid, Liquid, and Gaseous.

Their Analysis and Valuation. For the use of Chemists and Engineers. By H. J. PHILLIPS, F.C.S., formerly Analytical and Consulting Chemist to the Great Eastern Railway. Second Edition, revised 2/0

"Ought to have its place in the laboratory of every metallurgical establishment, and wherever fuel is used on a large scale."—*Chemical News*.

Fuel, Its Combustion and Economy.

Consisting of an Abridgment of "A Treatise on the Combustion of Coal and the Prevention of Smoke." By C. W. WILLIAMS, A.I.C.E. With extensive Additions by D. KINNEAR CLARK, M. Inst. C.E. Third Edition, corrected 3/6

"Students should buy the book and read it, as one of the most complete and satisfactory treatises on the combustion and economy of fuel to be had."—*Engineer*.

Boilermaker's Assistant

In Drawing, Templatting, and Calculating Boiler Work, &c. By J. COURTNEY, Practical Boilermaker. Edited by D. K. CLARK, C.E. Third Edition, revised 2/0

"With very great care we have gone through the 'Boilermaker's Assistant,' and have to say that it has our unqualified approval. Scarcely a point has been omitted."—*Foreman Engineer*.

Boilermaker's Ready Reckoner

With Examples of Practical Geometry and Templatting for the Use of Platers, Smiths, and Riveters. By JOHN COURTNEY. Edited by D. K. CLARK, M.I.C.E. 4/0

* * * The last two Works in One Vol., half-bound, entitled "THE BOILERMAKER'S READY RECKONER AND ASSISTANT." By J. COURTNEY and D. K. CLARK. Price 7/0

"A most useful work. No workman or apprentice should be without it."—*Iron Trade Circular*.

Steam Boilers.

Their Construction and Management. By R. ARMSTRONG, C.E. Illustrated 1/6
"A mass of information suitable for beginners."—*Design and Work*.

Steam and Machinery Management.

A Guide to the Arrangement and Economical Management of Machinery, with Hints on Construction and Selection. By M. POWIS BALLE, M. Inst. M.E. 2/6

"Gives the results of wide experience."—*Lloyd's Newspaper*.

Steam and the Steam Engine,

Stationary and Portable. Being an Extension of the Treatise on the Steam Engine of Mr. J. SEWELL. By D. K. CLARK, C.E. Third Edition 3/6

"Every essential part of the subject is treated of competently, and in a popular style."—*Iron*.

The Steam Engine,

A Treatise on the Mathematical Theory of, with Rules and Examples for Practical Men. By T. BAKER, C.E. 1/6

"Treats with scientific information with reference to the steam-engine."—*Design and Work*.

The Steam Engine.

For the use of Beginners. By Dr. LARDNER. Illustrated 1/6

Locomotive Engines.

A Rudimentary Treatise on. By G. D. DEMPSEY, C.E. With large Additions treating of the Modern Locomotive, by D. K. CLARK, M. Inst. C.E. With Illustrations 3/0

"A model of what an elementary technical book should be."—*Academy*.

Locomotive Engine-Driving.

A Practical Manual for Engineers in Charge of Locomotive Engines. By MICHAEL REYNOLDS, M.S.E. Eighth Edition. 3/6 limp; cloth boards 4/6
 "We can confidently recommend the book, not only to the practical driver, but to everyone who takes an interest in the performance of locomotive engines."—*The Engineer*.

Stationary Engine Driving.

A Practical Manual for Engineers in Charge of Stationary Engines. By MICHAEL REYNOLDS, M.S.E. Fourth Edition. 3/6 limp; cloth boards 4/6
 "The author is thoroughly acquainted with his subjects, and has produced a manual which is an exceedingly useful one for the class for whom it is specially intended."—*Engineering*.

Smithy and Forge.

Including the Farrier's Art and Coach Smithing. By W. J. E. CRANE. 2/6
 "The first modern English book on the subject. Great pains have been bestowed by the author upon the book; shoeing-smiths will find it both useful and interesting."—*Builder*.

Modern Workshop Practice,

As applied to Marine, Land, and Locomotive Engines, Floating Docks, Dredging Machines, Bridges, Ship-Building, &c. By J. G. WINTON. 4th Edn., Illustrated 3/6
 "Whether for the apprentice determined to master his profession, or for the artisan bent upon raising himself to a higher position, this clearly-written and practical treatise will be a great help."—*Scotsman*.

Mechanical Engineering.

Comprising Metallurgy, Moulding, Casting, Forging, Tools, Workshop Machinery, Mechanical Manufacture, Manufacture of the Steam Engine, &c. By FRANCIS CAMPIN, C.E. Third Edition, Re-written and Enlarged [Just published.] 2/6
 "A sound and serviceable text-book, quite up to date."—*Building News*.

Details of Machinery.

Comprising Instructions for the Execution of various Works in Iron in the Fitting-shop, Foundry, and Boiler-Yard. By FRANCIS CAMPIN, C.E. 3/0
 "A sound and practical handbook for all engaged in the engineering trades."—*Building World*.

Elementary Engineering:

A Manual for Young Marine Engineers and Apprentices. In the Form of Questions and Answers on Metals, Alloys, Strength of Materials, &c. By J. S. BREWER. Second Edition 1/6
 "A useful introduction to the more elaborate text-books."—*Scotsman*.

Power in Motion :

Horse-power Motion, Toothing-Wheel Gearing, Long and Short Driving Bands, Angular Forces, &c. By JAMES ARMOUR, C.E. With 73 Diagrams. Third Edition 2/0
 "The value of the knowledge imparted cannot well be over-estimated."—*Newcastle Weekly Chron.*

Iron and Heat.

Exhibiting the Principles concerned in the Construction of Iron Beams, Pillars and Girders. By J. ARMOUR, C.E. 2/6
 "A very useful and thoroughly practical little volume."—*Mining Journal*.

Practical Mechanism,

And Machine Tools. By T. BAKER, C.E. With Remarks on Tools and Machinery by J. NASMYTH, C.E. 2/6

Mechanics.

Being a concise Exposition of the General Principles of Mechanical Science, and their Applications. By CHARLES TOMLINSON, F.R.S. 1/6

Cranes,

The Construction of, and other Machinery for Raising Heavy Bodies for the Erection of Buildings, &c. By JOSEPH GLYNN, F.R.S. 1/6

NAVIGATION, SHIPBUILDING, ETC.**Sailor's Sea Book :**

A Rudimentary Treatise on Navigation. By JAMES GREENWOOD, B.A. With numerous Woodcuts and Coloured Plates. New and Enlarged Edition. By W. H. ROSSER 2/6
 "Is perhaps the best and simplest epitome of navigation ever compiled."—*Field*.

Practical Navigation.

Consisting of the SAILOR'S SEA BOOK, by JAMES GREENWOOD and W. H. ROSSER; together with Mathematical and Nautical Tables for the Working of the Problems, by HENRY LAW, C.E., and Prof. J. R. YOUNG. Half-bound in leather 7/0

"A vast amount of information is contained in this volume, and we fancy in a very short time that it will be seen in the library of every ship afloat."—*Hunt's Yachting Magazine*.

Navigation and Nautical Astronomy,

In Theory and Practice. By Prof. J. R. YOUNG. New Edition. Illustrated 2/6
 "A very complete, thorough, and useful manual for the young navigator."—*Observatory*.

Mathematical Tables,

For Trigonometrical, Astronomical, and Nautical Calculations ; to which is prefixed a Treatise on Logarithms, by H. LAW, C.E. Together with a Series of Tables for Navigation and Nautical Astronomy. By Professor J. R. YOUNG. New Edition 4/0

Masting, Mast-Making, and Rigging of Ships.

Also Tables of Spars, Rigging, Blocks ; Chain, Wire, and Hemp Ropes, &c., relative to every class of vessels. By ROBERT KIPPING, N.A. 2/0

Sails and Sail-Making.

With Draughting, and the Centre of Effort of the Sails. Weights and Sizes of Ropes ; Masting, Rigging, and Sails of Steam Vessels, &c. By R. KIPPING, N.A. 2/6

Marine Engines and Steam Vessels.

By R. MURRAY, C.E. Eighth Edition, thoroughly Revised, with Additions by the Author and by GEORGE CARLISLE, C.E. 4/6

"An indispensable manual for the student of marine engineering."—*Liverpool Mercury*.

Naval Architecture.

An Exposition of the Elementary Principles. By JAMES PEAKE 3/6

Ships for Ocean and River Service,

Principles of the Construction of. By H. A. SOMMERFELDT 1/6

An Atlas of Engravings

To Illustrate the above. Twelve large folding Plates. Royal 4to, cloth 7/6

Ships and Boats.

By W. BLAND. Seventh Edition, revised, with numerous Illustrations and Models 1/6

ARCHITECTURE AND BUILDING.**Constructional Iron and Steel Work,**

As applied to Public, Private, and Domestic Buildings. By FRANCIS CAMPIN, C.E. 3/6

"Anyone who wants a book on ironwork as employed for stanchions, columns, and beams, will find the present volume to be suitable."—*British Architect*.

Building Estates:

A Treatise on the Development, Sale, Purchase, and Management of Building Land.

By F. MATTLAND. Second Edition, revised 2/0

"This book should undoubtedly be added to the library of every professional man dealing with building land."—*Land Agent's Record*.

Science of Building :

An Elementary Treatise on the Principles of Construction. By E. WYNDHAM TARN,

M.A. Lond. Third Edition, revised and enlarged 3/6

Art of Building,

Rudiments of. General Principles of Construction, Strength, and Use of Materials,

Working Drawings, Specifications, &c. By EDWARD DOBSON, M.R.I.B.A. &c. 2/0

"A good book for practical knowledge, and about the best to be obtained."—*Building News*.

Book on Building,

Civil and Ecclesiastical. By Sir EDMUND BECKETT, Bart., LL.D., Q.C., F.R.A.S.,

Author of "Clocks and Watches and Bells," &c. Second Edition, enlarged. 4/6

"A book which is always amusing and nearly always instructive."—*Times*.

Dwelling-Houses,

Erection of, Illustrated by a Perspective View, Plans, Elevations, and Sections of a Pair of Villas, with the Specification, Quantities, and Estimates. By S. H. BROOKS 2/6

Cottage Building.

By C. BRUCE ALLEN. Eleventh Edition, with Chapter on Economic Cottages for

Allotments, by E. E. ALLEN, C.E. 2/0

Acoustics of Public Buildings :

The Laws of Sound as applied to the Arrangement of Buildings. By Professor T. ROGER SMITH, F.R.I.B.A. New Edition, revised. With numerous Illustrations.

[Just published.] 1/6

Practical Bricklaying.

General Principles of Bricklaying ; Arch Drawing, Cutting and Setting ; Pointing ;

Paving, Tiling, &c. By ADAM HAMMOND. With 68 Woodcuts 1/6

"The young bricklayer will find it infinitely valuable to him."—*Glasgow Herald*.

Art of Practical Brick-Cutting and Setting.

By ADAM HAMMOND. With 90 Engravings 1/6

Brickwork :

Embodying the General and Higher Principles of Bricklaying, Cutting and Setting; with the Application of Geometry to Roof Tiling, &c. By F. WALKER 1/8
 "Contains all that a young tradesman or student needs to learn from books."—*Building News*.

Bricks and Tiles,

Rudimentary Treatise on the Manufacture of. Containing an Outline of the Principles of Brickmaking. By E. DOBSON, M.R.I.B.A. Additions by C. TOMLINSON, F.R.S. Illustrated 3/0

"The best handbook on the subject. We can safely recommend it as a good investment."—*Builder*.

Practical Brick and Tile Book.

Comprising : BRICK AND TILE MAKING, by E. DOBSON, M.Inst.C.E.; Practical BRICK-LAYING, by A. HAMMOND; BRICK-CUTTING and SETTING, by A. HAMMOND. 550 pp. with 270 Illustrations, strongly half-bound 6/0

Carpentry and Joinery—

THE ELEMENTARY PRINCIPLES OF CARPENTRY. Chiefly composed from the Standard Work of THOMAS TREDGOLD, C.E. With Additions, and a TREATISE ON JOINERY by E. W. TARN, M.A. Sixth Edition, revised and extended 8/6

Carpentry and Joinery.

Atlas of 35 Plates to accompany and illustrate the foregoing book. With Descriptive Letterpress. 4to. 6/0

"These two volumes form a complete treasury of carpentry and joinery, and should be in the hands of every carpenter and joiner in the Empire."—*Iron*.

Practical Treatise on Handrailing:

Showing New and Simple Methods. By GEO. COLLINGS. Second Edition, Revised, including a TREATISE ON STAIRBUILDING. With Plates 2/6

"Will be found of practical utility in the execution of this difficult branch of joinery."—*Builder*.

Circular Work in Carpentry and Joinery.

A Practical Treatise on Circular Work of Single and Double Curvature. By GEORGE COLLINGS. Second Edition 2/6

"Cheap in price, clear in definition, and practical in the examples selected."—*Builder*.

Roof Carpentry :

Practical Lessons in the Framing of Wood Roofs. For the use of Working Carpenters. By GEO. COLLINGS, Author of "Handrailing and Stairbuilding," &c. 2/0

Construction of Roofs, of Wood and Iron :

Deduced chiefly from the Works of Robison, Tredgold, and Humber. By E. WYNDHAM TARN, M.A., Architect. Second Edition, revised 1/6

"Mr. Tarn is so thoroughly master of his subject, that although the treatise was founded on the works of others he has given it a distinct value of its own. It will be found valuable by all students."—*Builder*.

The Joints Made and Used by Builders.

By WYVILL J. CHRISTY, Architect. With 160 Woodcuts 3/0

"The work is deserving of high commendation."—*Builder*.

Shoring,

And its Application: A Handbook for the use of Students. By G. H. BLAGROVE 1/6

"We recommend this valuable treatise to all students."—*Building News*.

Timber Importer's, Timber Merchant's, and Builder's Standard Guide.

By R. E. GRANDY. 2/0

"Everything it pretends to be: built up gradually, it leads one from a forest to a treenail, and throws in, as a makeweight, a host of material concerning bricks, columns, cisterns, &c."—*English Mechanic*.

Plumbing :

A Text-Book to the Practice of the Art or Craft of the Plumber. With Chapters upon House Drainage and Ventilation. By WM. PATON BUCHAN, R.P., Sanitary Engineer.

Eighth Edition, Re-written and Enlarged, with 500 Illustrations 8/8

"A text-book which may be safely put into the hands of every young plumber, and which will also be found useful by architects and medical professors."—*Builder*.

Ventilation :

A Text-Book to the Practice of the Art of Ventilating Buildings. By W. P. BUCHAN, R.P., Author of "Plumbing," &c. With 170 Illustrations 8/6

The Practical Plasterer :

A Compendium of Plain and Ornamental Plaster Work. By WILFRED KEMP 2/0

House Painting, Graining, Marbling, and Sign Writing :

With a Course of Elementary Drawing, and a Collection of Useful Receipts. By ELLIS A. DAVIDSON. Eighth Edition. Coloured Plates 5/0

* * * The above, in cloth boards, strongly bound, 6/0.

"A mass of information of use to the amateur and of value to the practical man."—*English Mechanic*.

Grammar of Colouring.

Applied to Decorative Painting and the Arts. By GEORGE FIELD. New Edition, revised and enlarged by ELLIS A. DAVIDSON. With Coloured Plates 3/0
"The book is a most useful *résumé* of the properties of pigments."—*Builder*.

Elementary Decoration :

As Applied to Dwelling-Houses, &c. By JAMES W. FACEY. Illustrated 2/0
"The principles which ought to guide the decoration of dwelling-houses are clearly set forth, and elucidated by examples; while full instructions are given to the learner."—*Scotsman*.

Practical House Decoration.

A Guide to the Art of Ornamental Painting, the Arrangement of Colours in Apartments, and the Principles of Decorative Design. By JAMES W. FACEY 2/6
** The last two Works in One handsome Vol., half-bound, entitled "HOUSE DECORATION, ELEMENTARY AND PRACTICAL," price 5/0.

Portland Cement for Users.

By HENRY FAJJA, A.M. Inst. C.E. Third Edition, corrected 2/0
"Supplies in a small compass all that is necessary to be known by users of cement."—*Building News*.

Limes, Cements, Mortars, Concretes, Mastics, Plastering, &c.

By G. R. BURNELL, C.E. Thirteenth Edition 1/6

Masonry and Stonecutting,

The Principles of Masonic Projection, and their Application to Construction. By E. DOBSON, M.R.I.B.A. 2/6

Arches, Piers, Buttresses, &c.

Experimental Essays on the Principles of Construction in. By WILLIAM BLAND 1/8

Quantities and Measurements,

In Bricklayers', Masons', Plasterers', Plumbers', Painters', Paperhanglers', Gilders', Smiths', Carpenters' and Joiners' Work. By A. C. BEATON, Surveyor 1/8
"This book is indispensable to builders and their quantity clerks."—*English Mechanic*.

Complete Measurer;

Setting forth the Measurement of Boards, Glass, Timber, and Stone. By R. HORTON. Fifth Edition 4/0
** The above, strongly bound in leather, price 5/0.

Light:

An Introduction to the Science of Optics. Designed for the Use of Students of Architecture, Engineering, and other Applied Sciences. By E. W. TARN, M.A. . . . 1/8

Hints to Young Architects.

By GEORGE WIGHTWICK, Architect, Author of "The Palace of Architecture," &c., &c. Fifth Edition, revised and enlarged by G. HUSKISSON GUILLAUME, Architect 3/6
"A copy ought to be considered as necessary a purchase as a box of instruments."—*Architect*.

Architecture—Orders.

The Orders and their Aesthetic Principles. By W. H. LEEDS. Illustrated 1/6

Architecture—Styles.

The History and Description of the Styles of Architecture of Various Countries, from the Earliest to the Present Period. By T. TALBOT BURY, F.R.I.B.A., &c. Illustrated 2/0
ORDERS AND STYLES OF ARCHITECTURE, in One Vol., 3/6.

Architecture—Design.

The Principles of Design in Architecture, as deducible from Nature and exemplified in the Works of the Greek and Gothic Architects. By EDW. L. GARRETT, Architect 2/6

"We know no work that we would sooner recommend to an apprentice or a student desirous to obtain clear views of the nature of architectural art. The book is a valuable one."—*Builder*.

** The three preceding Works in One handsome Vol., half-bound, entitled "MODERN ARCHITECTURE," price 6/0.

Architectural Modelling in Paper,

The Art of. By T. A. RICHARDSON. With Illustrations, engraved by O. JEWITT 1/6
"A valuable aid to the practice of architectural modelling."—*Builder's Weekly Reporter*.

Perspective for Beginners.

For Students and Amateurs in Architecture, Painting, &c. By G. PYNE 2/0

Glass Staining, and the Art of Painting on Glass.

From the German of Dr. GESSERT and EMANUEL OTTO FROMBERG. With an Appendix on THE ART OF ENAMELLING 2/0

Vitruvius—The Architecture of Marcus Vitruvius Pollio.

In Ten Books. Translated from the Latin by JOSEPH GWILT, F.S.A., F.R.A.S.
With 23 Plates 5/0

N.B.—This is the only Edition of VITRUVIUS procurable at a moderate price.

Grecian Architecture,

An Inquiry into the Principles of Beauty in; with an Historical View of the Rise and Progress of the Art in Greece. By the EARL OF ABERDEEN 1/0
** The two preceding Works in One handsome Vol., half-bound, entitled "ANCIENT ARCHITECTURE," price 6/0.

INDUSTRIAL AND USEFUL ARTS.

Cements, Pastes, Glues, and Gums.

A Guide to the Manufacture and Application of Agglutinants for Workshop, Laboratory, or Office Use. With 900 Recipes and Formulae. By H. C. STANDAGE 2/0
"As a revelation of what are considered trade secrets, this book will arouse an amount of curiosity among the large number of industries it touches."—*Daily Chronicle*.

Clocks and Watches, and Bells,

A Rudimentary Treatise. By Sir EDMUND BECKETT. Seventh Edition. 4/8
** The above, handsomely bound, Cloth Boards, 5/6.

"The best work on the subject probably extant. The treatise on bells is undoubtedly the best in the language."—*Engineering*. "The only modern treatise on clock-making."—*Horological Journal*.

Electro-Metallurgy,

Practically Treated. By ALEXANDER WATT. Tenth Edition, enlarged and revised. With Additional Illustrations, and including the most Recent Processes 3/8
"From this book both amateur and artisan may learn everything necessary."—*Iron*.

Goldsmith's Handbook,

Containing full Instructions in the Art of Alloying, Melting, Reducing, Colouring, Collecting, and Refining. The processes of Manipulation, Recovery of Waste, Chemical and Physical Properties of Gold ; Solders, Enamels, and other useful Rules and Recipes, &c. By GEORGE E. GEE. Third Edition, considerably enlarged 3/0
"A good, sound, technical educator."—*Horological Journal*.

Silversmith's Handbook,

On the same plan as the above. By GEORGE E. GEE. Second Edition, Revised 3/0
"A valuable sequel to the author's 'Practical Goldworker.'"—*Silversmith's Trade Journal*.
** The two preceding Works, in One handsome Vol., half-bound, entitled "THE GOLDSMITH'S AND SILVERSMITH'S COMPLETE HANDBOOK," 7/0.

Hall-Marking of Jewellery.

Comprising an account of all the different Assay Towns of the United Kingdom ; with the Stamps at present employed ; also the Laws relating to the Standards and Hall-Marks at the various Assay Offices. By GEORGE E. GEE. 3/0
"Deals thoroughly with its subject from a manufacturer's and dealer's point of view."—*Jeweller*.

French Polishing and Enamelling.

A Practical Book of Instruction, including numerous Recipes for making Polishes, Varnishes, Glaze-Lacquers, Revivers, etc. By RICHARD BITMEAD. [Just published. 1/6

Practical Organ Building.

By W. E. DICKSON, M.A., Precentor of Ely Cathedral. Second Edition, Revised 2/8
"The amateur builder will find in this book all that is necessary to enable him personally to construct a perfect organ with his own hands."—*Academy*.

Coach-Building :

A Practical Treatise, Historical and Descriptive. By JAMES W. BURGESS 2/8
"This handbook will supply a long-felt want, not only to manufacturers themselves, but more particularly apprentices, and others connected with the trade of coach-building."—*European Mail*.

The Cabinet-Maker's Guide

To the Entire Construction of Cabinet-Work, including Veneering, Marqueterie, Buhl-Work, Mosaic, Inlaying, Working and Polishing Ivory, Trade Recipes, &c. By RICHARD BITMEAD. With Plans, Sections, and Working Drawings. [Just published. 2/6

Brass Founder's Manual:

Instructions for Modelling, Pattern Making, Moulding, Turning, &c. By W. GRAHAM 2/0

Sheet Metal-Worker's Guide.

A Practical Handbook for Tinsmiths, Coppersmiths, Zincworkers, &c., with 46 Diagrams and Working Patterns. By W. J. E. CRANE. Second Edition, revised 1/6
"The author has acquitted himself with considerable tact in choosing his examples, and with no less ability in treating them."—*Plumber*.

Sewing Machinery.

Construction, History, Adjusting, &c. By J. W. URQUHART, C.E. 2/0

Gas Fitting:A Practical Handbook. By JOHN BLACK. Revised Edition. With 130 Illustrations 2/6
"It is written in a simple practical style, and we heartily recommend it."—*Plumber and Decorator.***Construction of Door Locks.**

From the Papers of A. C. HOBBS. Edited by CHARLES TOMLINSON, F.R.S. With a Note upon IRON SAFES by ROBERT MALLETT. Illustrated 2/6

The Model Locomotive Engineer, Fireman, and Engine-Boy.

By MICHAEL REYNOLDS 3/6

Art of Letter Painting made Easy.

By JAMES GREIG BADENOCH. With 12 full-page Engravings of Examples. 1/6

"Any intelligent lad who fails to turn out decent work after studying this system, has mistaken his vocation."—*English Mechanic.***Art of Boot and Shoemaking,**

Including Measurement, Last-fitting, Cutting-out, Closing and Making; with a Description of the most Approved Machinery employed. By J. B. LENO 2/0

"By far the best work ever written on the subject."—*Scottish Leather Trader.***Mechanical Dentistry:**

A Practical Treatise on the Construction of the Various Kinds of Artificial Dentures, comprising also Useful Formulae, Tables and Receipts. By C. HUNTER 3/0

Wood Engraving:

A Practical and Easy Introduction to the Study of the Art. By W. N. BROWN 1/6

Laundry Management.A Handbook for Use in Private and Public Laundries. Including Accounts of Modern Machinery and Appliances. By the EDITOR of *The Laundry Journal* 2/0"This book should certainly occupy an honoured place on the shelves of all housekeepers who wish to keep themselves *au courant* of the newest appliances and methods."—*The Queen.***AGRICULTURE, GARDENING, ETC.****Draining and Embanking.**

A Practical Treatise. By JOHN SCOTT, late Professor of Agriculture and Rural Economy at the Royal Agricultural College, Cirencester. With 68 Illustrations 1/6

"A valuable handbook to the engineer as well as to the surveyor."—*Land.***Irrigation and Water Supply:**

A Practical Treatise on Water Meadows, Sewage Irrigation, Warping, &c.; on the Construction of Wells, Ponds, and Reservoirs, &c. By Professor J. SCOTT 1/6

"A valuable and indispensable book for the estate manager and owner."—*Forestry.***Farm Roads, Fences, and Gates:**

A Practical Treatise on the Roads, Tramways, and Waterways of the Farm; the Principles of Enclosures; and on Fences, Gates, and Stiles. By Prof. JOHN SCOTT 1/6

"A useful practical work, which should be in the hands of every farmer."—*Farmer.***Farm Buildings:**

A Practical Treatise on the Buildings necessary for various kinds of Farms, their Arrangement and Construction, with Plans and Estimates. By Professor J. SCOTT 2/0

"No one who is called upon to design farm buildings can afford to be without this work."—*Builder.***Barn Implements and Machines:**

Treating of the Application of Power to the Operations of Agriculture: and of the various Machines used in the Threshing-barn, in the Stockyard, Dairy, &c. By Professor JOHN SCOTT. With 123 Illustrations 2/0

Field Implements and Machines:

With Principles and Details of Construction and Points of Excellence, their Management, &c. By Professor JOHN SCOTT. With 138 Illustrations 2/0

Agricultural Surveying:

A Treatise on Land Surveying, Levelling, and Setting-out; with Directions for Valuing and Reporting on Farms and Estates. By Professor J. SCOTT 1/6

Farm Engineering.

By Professor JOHN SCOTT. Comprising the above Seven Volumes in One, 1,150 pages, and over 600 Illustrations. Half-bound 12/0

"A copy of this work should be treasured up in every library where the owner thereof is in any way connected with land."—*Farm and Home.*

Outlines of Farm Management.

Treating of the General Work of the Farm; Stock; Contract Work; Labour, &c. By R. SCOTT BURN, Author of "Outlines of Modern Farming," &c. 2/6
 "The book is eminently practical, and may be studied with advantage by beginners in agriculture, while it contains hints which will be useful to old and successful farmers."—*Scoismen*.

Outlines of Landed Estates Management.

Treating of the Varieties of Lands, Methods of Farming, the Setting-out of Farms, &c.; Roads, Fences, Gates, Irrigation, Drainage, &c. By R. S. BURN 2/6
 "A complete and comprehensive outline of the duties appertaining to the management of landed estates."—*Journal of Forestry*.
 ** The above Two Vols. in One, handsomely half-bound, entitled "OUTLINES OF LANDED ESTATES AND FARM MANAGEMENT." By ROBERT SCOTT BURN. Price 6/0.

Soils, Manures, and Crops.

(Vol. I. OUTLINES OF MODERN FARMING.) By R. SCOTT BURN. Woodcuts 2/0

Farming and Farming Economy,

Historical and Practical. (Vol. II. OUTLINES OF MODERN FARMING.) By R. SCOTT BURN 3/0
 "Eminently calculated to enlighten the agricultural community on the varied subjects of which it treats; hence it should find a place in every farmer's library."—*City Press*.

Stock: Cattle, Sheep, and Horses.

(Vol. III. OUTLINES OF MODERN FARMING.) By R. SCOTT BURN. Woodcuts 2/6
 "The author's grasp of his subject is thorough, and his grouping of facts effective. . . . We commend this excellent treatise."—*Weekly Dispatch*.

Dairy, Pigs, and Poultry.

(Vol. IV. OUTLINES OF MODERN FARMING.) By R. SCOTT BURN. Woodcuts 2/0
 "We can testify to the clearness and intelligibility of the matter, which has been compiled from the best authorities."—*London Review*.

Utilization of Sewage, Irrigation, &c.

(Vol. V. OUTLINES OF MODERN FARMING.) By R. SCOTT BURN. Woodcuts 2/6
 "A work containing valuable information, which will recommend itself to all interested in modern farming."—*Field*.

Outlines of Modern Farming.

By R. SCOTT BURN, Author of "Landed Estates Management," &c. Consisting of the above Five Volumes in One, 1,250 pp., profusely Illustrated, half-bound 12/0
 "The aim of the author has been to make his work at once comprehensive and trustworthy, and in this aim he has succeeded to a degree which entitles him to much credit."—*Morning Advertiser*.

Book-keeping for Farmers and Estate Owners.

A Practical Treatise, presenting, in Three Plans, a System adapted for all classes of Farms. By J. M. WOODMAN, Chartered Accountant. Third Edition, revised 2/6
 "Will be found of great assistance by those who intend to commence a system of book-keeping, the author's examples being clear and explicit, and his explanations full and accurate."—*Livestock Journal*.

Ready Reckoner for Admeasurement of Land.

By A. ARMAN. Third Edition, revised and extended by C. NORRIS, Surveyor 2/0
 "A very useful book to all who have land to measure."—*Mark Lane Express*.
 "Should be in the hands of all persons having any connection with land."—*Irish Farm*.

Ready Reckoner for Millers, Corn Merchants,

And Farmers. Second Edition, revised, with a Price List of Modern Flour Mill Machinery. By W. S. HUTTON, C.E. 2/0
 "Will prove an indispensable *vade mecum*. Nothing has been spared to make the book complete and perfectly adapted to its special purpose."—*Miller*.

The Hay and Straw Measurer:

New Tables for the use of Auctioneers, Valuers, Farmers, Hay and Straw Dealers, &c., forming a complete Calculator and Ready Reckoner. By JOHN STEELE 2/0
 "A most useful handbook. It should be in every professional office where agricultural valuations are conducted."—*Land Agent's Record*.

Meat Production:

A Manual for Producers, Distributors, and Consumers of Butchers' Meat. By JOHN EWART 2/6
 "A compact and handy volume on the meat question."—*Meat and Provision Trades Review*.

Sheep:

The History, Structure, Economy, and Diseases of. By W. C. SPOONER. Fifth Edition, wit: Numerous, including Specimens of New and Improved Breeds 3/6
"The best of the kind in our language."—*Scotsman*.

Market and Kitchen Gardening.

By C. W. SHAW, late Editor of "Gardening Illustrated" 3/0
"The most valuable compendium of kitchen and market-garden work published."—*Farmer*.

Kitchen Gardening made Easy.

Show: the best means of Cultivating every known Vegetable and Herb, &c., with directions for the year round. By GEO. M. F. GLENNY. Illustrated 1/6
"This book will be found trustworthy and useful."—*North British Agriculturist*.

Cottage Gardening;

Or, Flowers, Fruits, and Vegetables for Small Gardens. By E. HOBDAY 1/6
"Definite instructions as to the cultivation of small gardens."—*Scotsman*.

Garden Receipts.

Edited by CHARLES W. QUIN. Third Edition 1/6
"A singularly complete collection of the principal receipts needed by gardeners."—*Farmer*.

Fruit Trees,

The Scientific and Profitable Culture of. From the French of M. DU BREUIL. Fourth Edition, carefully Revised by GEORGE GLENNY. With 187 Woodcuts 3/6
"The book teaches how to prune and train fruit trees to perfection."—*Field*.

Tree Planter and Plant Propagator:

With numerous Illustrations of Grafting, Layering, Budding, Implements, Houses, Pits, &c. By S. WOOD, Author of "Good Gardening," &c. 2/0
"Sound in its teaching and very comprehensive in its aim. It is a good book."—*Gardeners' Magazine*.

Tree Pruner:

Being a Practical Manual on the Pruning of Fruit Trees, including also their Training and Renovation, also treating of the Pruning of Shrubs, Currants, &c., &c. Plants. With numerous Illustrations. By SAMUEL WOOD, Author 1/6
"A useful book, written by one who has had great experience."

* * The above Two Vols. in One, handsomely half-bound, entitled "THE TREE PLANTER, PROPAGATOR AND PRUNER." By SAMUEL WOOD. Price 3/6.

Art of Grafting and Budding.

By CHARLES BALLET. With Illustrations 2/6
"The one standard work on this subject."—*Scotsman*.

MATHEMATICS, ARITHMETIC, ETC.**Descriptive Geometry,**

An Elementary Treatise on ; with a Theory of Shadows and of Perspective, extracted from the French of G. MONGE. To which is added a Description of the Principles and Practice of Isometrical Projection. By J. F. HEATHER, M.A. With 14 Plates. 2/0

Practical Plane Geometry:

Giving the Simplest Modes of Constructing Figures contained in one Plane and Geometrical Construction of the Ground. By J. F. HEATHER, M.A. 2/0

"The author is well-known as an experienced professor, and the volume contains as complete a collection of problems as is likely to be required in ordinary practice."—*Architect*.

Analytical Geometry and Conic Sections.

By JAMES HANN. New Edition, Enlarged by Professor J. R. YOUNG 2/0

"The author's style is exceedingly clear and simple, and the book is well adapted for the beginner and those who may be obliged to have recourse to self-tuition."—*Engineer*.

Euclid,

THE ELEMENTS OF ; with many Additional Propositions and Explanatory Notes ; to which is prefixed an Introductory Essay on Logic. By HENRY LAW, C.E. 2/6

* * Sold also separately, viz.:—

EUCLID. The First Three Books. By HENRY LAW, C.E. 1/6

EUCLID. Books 4, 5, 6, 11, 12. By HENRY LAW, C.E. 1/6

Plane Trigonometry,

The Elements of. By JAMES HANN, M.A. Sixth Edition 1/6

Spherical Trigonometry,

The Elements of. By JAMES HANN. Revised by CHARLES H. DOWLING, C.E. 1/0
 * * Or with "The Elements of Plane Trigonometry," in One Vol., 2/6.

Differential Calculus,

Elements of the. By W. S. B. WOOLHOUSE, F.R.A.S., &c. 1/6

Integral Calculus.

By HOMERSHAM COX, B.A. 1/6

Algebra,

The Elements of. By JAMES HADDON, M.A., formerly Mathematical Master of King's College School. With Appendix, containing Miscellaneous Investigations, and a collection of Problems 2/0

Key and Companion to the Above.

An extensive repository of Solved Examples and Problems in Illustration of the various Expedients necessary in Algebraical Operations. By J. R. YOUNG 1/6

Commercial Book-keeping.

With Commercial Phrases and Forms in English, French, Italian, and German. By JAMES HADDON, M.A., formerly Mathematical Master, King's College School 1/6

Arithmetic,

A Rudimentary Treatise on : with full Explanations of its Theoretical Principles, and numerous Examples for Practice. For the use of Schools and for Self-Instruction. By J. R. YOUNG, late Professor of Mathematics in Belfast College. Eleventh Edition 1/6

Key to the Above.

By J. R. YOUNG 1/6

Equational Arithmetic,

Applied to Questions of Interest, Annuities, Life Assurance, and General Commerce : with various Tables by which all calculations may be greatly facilitated. By W. HIPSLEY 1/6

Arithmetic,

Rudimentary, for the Use of Schools and Self-Instruction. By JAMES HADDON, M.A. Revised by ABRAHAM ARMAN 1/6

Key to the Above.

By A. ARMAN 1/6

Mathematical Instruments,

A Treatise on ; Their Construction, Adjustment, Testing, and Use concisely explained. By J. F. HEATHER, M.A., of the Royal Military Academy, Woolwich. Fourteenth Edition, Revised with Additions, by A. T. WALMISLEY, M.I.C.E., Fellow of the Surveyors' Institution. Original Edition in One Vol., Illustrated 2/0

* * In ordering be careful to say "Original Edition," to distinguish it from the Enlarged Edition in Three Vols. (see below).

Drawing and Measuring Instruments.

Including—I. Instruments employed in Geometrical and Mechanical Drawing, and in the Construction, Copying, and Measurement of Maps and Plans. II. Instruments used for the purposes of Accurate Measurement, and for Arithmetical Computations. By J. F. HEATHER, M.A. 1/6

Optical Instruments.

Including (more especially) Telescopes, Microscopes, and Apparatus for producing copies of Maps and Plans by Photography. By J. F. HEATHER, M.A. Illustrated 1/6

Surveying and Astronomical Instruments.

Including—I. Instruments used for Determining the Geometrical Features of a portion of Ground. II. Instruments employed in Astronomical Observations. By J. F. HEATHER, M.A. Illustrated 1/6

* * The above Three Volumes form an enlargement of the Author's original work, "Mathematical Instruments," price 2/0.

Mathematical Instruments:

Their Construction, Adjustment, Testing and Use. Comprising Drawing, Measuring, Optical, Surveying, and Astronomical Instruments. By J. F. HEATHER, M.A. Enlarged Edition, for the most part re-written. Three Parts as above 4/6

"An exhaustive treatise, belonging to the well-known Weale's Series. Mr. Heather's experience well qualifies him for the task he has so ably fulfilled."—Engineering and Building Times.

Slide Rule, and How to Use It.

Containing full, easy, and simple Instructions to perform all Business Calculations with great rapidity and accuracy. By CHARLES HOARE, C.E. With a Slide Rule. Second Edition 2/6

Mathematical Tables,

For Trigonometrical, Astronomical, and Nautical Calculations ; to which is prefixed a Treatise on Logarithms. By H. LAW, C.E. Together with a Series of Tables for Navigation and Nautical Astronomy. By Professor J. R. YOUNG. New Edition 4/0

Logarithms.

With Mathematical Tables for Trigonometrical, Astronomical, and Nautical Calculations. By HENRY LAW, C.E. Revised Edition. (Forming part of the above work) 3/0

Theory of Compound Interest and Annuities:

With Tables of Logarithms for the more Difficult Computations of Interest, Discount, Annuities, &c., in all their Applications and Uses for Mercantile and State Purposes. By FEDOR THOMAN, of the Société Crédit, Mobilier, Paris. Fourth Edition . 4/0

"A very powerful work, and the author has a very remarkable command of his subject."—Professor A. DE MORGAN. "We recommend it to the notice of actuaries and accountants."—*Athenaeum*.

Treatise on Mathematics,

As applied to the Constructive Arts. By FRANCIS CAMPIN, C.E., &c. 2nd Edn. 3/0

"Should be in the hands of every one connected with building construction."—*Builders' Reporter*.

Astronomy.

By the late Rev. ROBERT MAIN, M.A., F.R.S. Third Edition, revised and corrected.

By WILLIAM THYNNE LYNN, B.A., F.R.A.S. 2/0

"A sound and simple treatise, very carefully edited, and a capital book for beginners."—*Knowledge*.

Statics and Dynamics,

The Principles and Practice of ; embracing also a clear development of Hydrostatics, Hydrodynamics, and Central Forces. By T. BAKER, C.E. Fourth Edition . 1/6

BOOKS OF REFERENCE AND MISCELLANEOUS VOLUMES.

Manual of the Mollusca :

A Treatise on Recent and Fossil Shells. By Dr. S. P. WOODWARD, A.L.S. With Appendix by RALPH TATE, A.L.S., F.G.S. With numerous Plates and 300 Woodcuts 7/6

"A storehouse of conchological and geological information."—*Hardwicke's Science Gossip*.

Dictionary of Painters,

And Handbook for Picture Amateurs ; being a Guide for Visitors to Public and Private Picture Galleries, and for Art Students, including Glossary of Terms, &c. By PHILIPPE DARYL, B.A. 2/6

"Considering its small compass, really admirable. We cordially recommend the book."—*Builder*.

Painting Popularly Explained.

By THOMAS JOHN GULLICK, Painter, and JOHN TIMBS, F.S.A. Including Fresco, Oil, Mosaic, Water Colour, Water-Glass, Tempera, Encaustic, Miniature, Painting on Ivory, Vellum, Pottery, Enamel, Glass, &c. Fifth Edition 5/0

* * * Adopted as a Prize Book at South Kensington.

"Much may be learned, even by those who fancy they do not require to be taught, from the careful perusal of this unpretending but comprehensive treatise."—*Art Journal*.

Dictionary of Terms used in Architecture,

Building, Engineering, Mining, Metallurgy, Archaeology, the Fine Arts, &c. By JOHN WEALE. Sixth Edition. Edited by ROBT. HUNT, F.R.S., Keeper of Mining Records, Editor of "Ure's Dictionary." Numerous Illustrations 5/0

* * * The above, strongly bound in cloth boards, price 6/0.

"The best small technological dictionary in the language."—*Architect*.

Music,

A Rudimentary and Practical Treatise on. By CHARLES CHILD SPENCER 2/6

"Mr. Spencer has marshalled his information with much skill, and yet with a simplicity that must recommend his works to all who wish to thoroughly understand music."—*Weekly Times*.

Pianoforte,

The Art of Playing the. With Exercises and Lessons. By C. C. SPENCER 1/6

"A sound and excellent work, written with spirit, and calculated to inspire the pupil with a desire to aim at high accomplishment in the art."—*School Board Chronicle*.

House Manager:

Being a Guide to Housekeeping, Practical Cookery, Pickling and Preserving, Household Work, Dairy Management, the Table and Dessert, Cellarage of Wines, Home-brewing and Wine-making, the Boudoir and Dressing-room, Travelling, Stable Economy, Gardening Operations, &c. By AN OLD HOUSEKEEPER 8/6

"We find here directions to be discovered in no other book, tending to save expense to the pocket, as well as labour to the head."—John Bull.

Manual of Domestic Medicine.

By R. GOODING, B.A., M.D. Intended as a Family Guide in all Cases of Accident and Emergency. Third Edition, carefully revised 2/0

"The author has performed a useful service by placing at the disposal of those situated at a distance from medical aid, a reliable and sensible work in which professional knowledge and accuracy have been well seconded by the ability to express himself in ordinary untechnical language."—Public Health.

Management of Health.

A Manual of Home and Personal Hygiene. By the Rev. JAMES BAIRD, B.A. 1/0

"It is wonderfully reliable, it is written with excellent taste, and there is instruction crowded into every page."—English Mechanic.

House Book,

Comprising—I. THE HOUSE MANAGER. By AN OLD HOUSEKEEPER. II. DOMESTIC MEDICINE. By RALPH GOODING, M.D. III. MANAGEMENT OF HEALTH. By JAMES BAIRD. In One Vol, strongly half-bound 8/0

Natural Philosophy,

For the Use of Beginners. By CHARLES TOMLINSON, F.R.S. 1/6

Electric Lighting:

The Elementary Principles of. By ALAN A. CAMPBELL SWINTON, M.Inst.C.E., M.Inst.E.E. With 16 Illustrations. Fourth Edition, Revised [Just published]. 1/6

Electric Telegraph :

Its History and Progress; with Descriptions of some of the Apparatus. By R. SABINE, C.E., F.S.A., &c. 8/0

"Essentially a practical and instructive work."—Daily Telegraph.

Handbook of Field Fortification.

By Major W. W. KNOLLYS, F.R.G.S. With 163 Woodcuts. 3/0

"A well-timed and able contribution to our military literature. . . . The author supplies, in clear business style, all the information likely to be practically useful."—Chambers of Commerce Chronicle.

Logic,

Pure and Applied. By S. H. EMMENS. Third Edition. 1/6

"This admirable work should be a text-book not only for schools, students, and philosophers, for all litterateurs and men of science, but for those concerned in the practical affairs of life, &c."—The News.

Locke's Essays on the Human Understanding.

Selections, with Notes by S. H. EMMENS 1/6

Compendious Calculator

(*Intuitive Calculations*); or Easy and Concise Methods of performing the various Arithmetical Operations required in Commercial and Business Transactions; together with Useful Tables, &c. By DANIEL O'GORMAN. Twenty-seventh Edition, carefully revised by C. NORRIS 2/6. Strongly half-bound 3/6

"It would be difficult to exaggerate the usefulness of this book to every one engaged in commerce or manufacturing industry. It is crammed full with rules and formulae for shortening and employing calculations in money, weights and measures, &c., of every sort and description."—Knowledge.

Measures, Weights, and Money of all Nations,

And an Analysis of the Christian, Hebrew, and Mahometan Calendars. By W. S. B. WOOLHOUSE, F.R.A.S., F.S.S. Seventh Edition 2/6

"A work necessary for every mercantile office."—Building Trades Journal.

Grammar of the English Tongue,

Spoken and Written. With an Introduction to the Study of Comparative Philology. By HYDE CLARKE, D.C.L. Fifth Edition 1/6

Dictionary of the English Language,

As Spoken and Written. Containing about 100,000 Words. By HYDE CLARKE, D.C.L. 8/6

* * Complete with the GRAMMAR, 5/6.

Composition and Punctuation,

Familiarly Explained for those who have neglected the Study of Grammar. By JUSTIN BRENNAN. Eighteenth Edition 1/6

French Grammar.

With Complete and Concise Rules on the Genders of French Nouns. By
G. L. STRAUSS, PH.D. 1/6

English-French Dictionary.

By ALFRED ELWES 2/0

French Dictionary.

In Two Parts : I. French-English. II. English-French. Complete in One Vol. 3/0
** Or with the GRAMMAR, 4/6.

French and English Phrase Book.

Containing Introductory Lessons, with Translations, Vocabularies of Words, Collection
of Phrases, and Easy Familiar Dialogues 1/6

German Grammar.

Adapted for English Students, from Heyse's Theoretical and Practical Grammar, by
Dr. G. L. STRAUSS 1/6

German Triglot Dictionary.

By N. E. S. A. HAMILTON. Part I. German-French-English. Part II. English-
German-French. Part III. French-German-English 3/0

German Triglot Dictionary

(As above). Together with German Grammar in One Vol. 5/0

Italian Grammar

Arranged in Twenty Lessons, with Exercises. By ALFRED ELWES 1/6

Italian Triglot Dictionary,

Wherein the Genders of all the Italian and French Nouns are carefully noted down.
By ALFRED ELWES. Vol. I. Italian-English-French 2/6

Italian Triglot Dictionary.

By ALFRED ELWES. Vol. II. English-French-Italian 2/6

Italian Triglot Dictionary.

By ALFRED ELWES. Vol. III. French-Italian-English 2/6

Italian Triglot Dictionary

(As above). In One Vol. 7/6

Spanish Grammar.

In a Simple and Practical Form. With Exercises. By ALFRED ELWES 1/6

Spanish-English and English-Spanish Dictionary.

Including a large number of Technical Terms used in Mining, Engineering, &c., with
the proper Accents and the Gender of every Noun. By ALFRED ELWES 4/0

** Or with the GRAMMAR, 6/0.

Portuguese Grammar,

In a Simple and Practical Form. With Exercises. By ALFRED ELWES 1/6

**Portuguese-English and English-Portuguese Dic-
tionary.**

Including a large number of Technical Terms used in Mining, Engineering, &c., with
the proper Accents and the Gender of every Noun. By ALFRED ELWES. Third
Edition, revised 5/0

** Or with the GRAMMAR, 7/0.

Animal Physics,

Handbook of. By DIONYSIUS LARDNER, D.C.L. With 520 Illustrations. In One Vol.
(732 pages), cloth boards 7/6

** Sold also in Two Parts, as follows:—

ANIMAL PHYSICS. By Dr. LARDNER. Part I., Chapters I.—VII. 4/0

ANIMAL PHYSICS. By Dr. LARDNER. Part II. Chapters VIII.—XVIII. 3/0

666125

Central Archaeological Library,
NEW DELHI.
Acc. 20301

Call No. 693.02
Pur

Author—Purchase, W.R.

Title—Practical masonry: A
guide to the art of
stone cutting.

Borrower No.	Date of Issue	Date of Return
Graves, A.C.	27/8/87	28/8/87